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No. 2878

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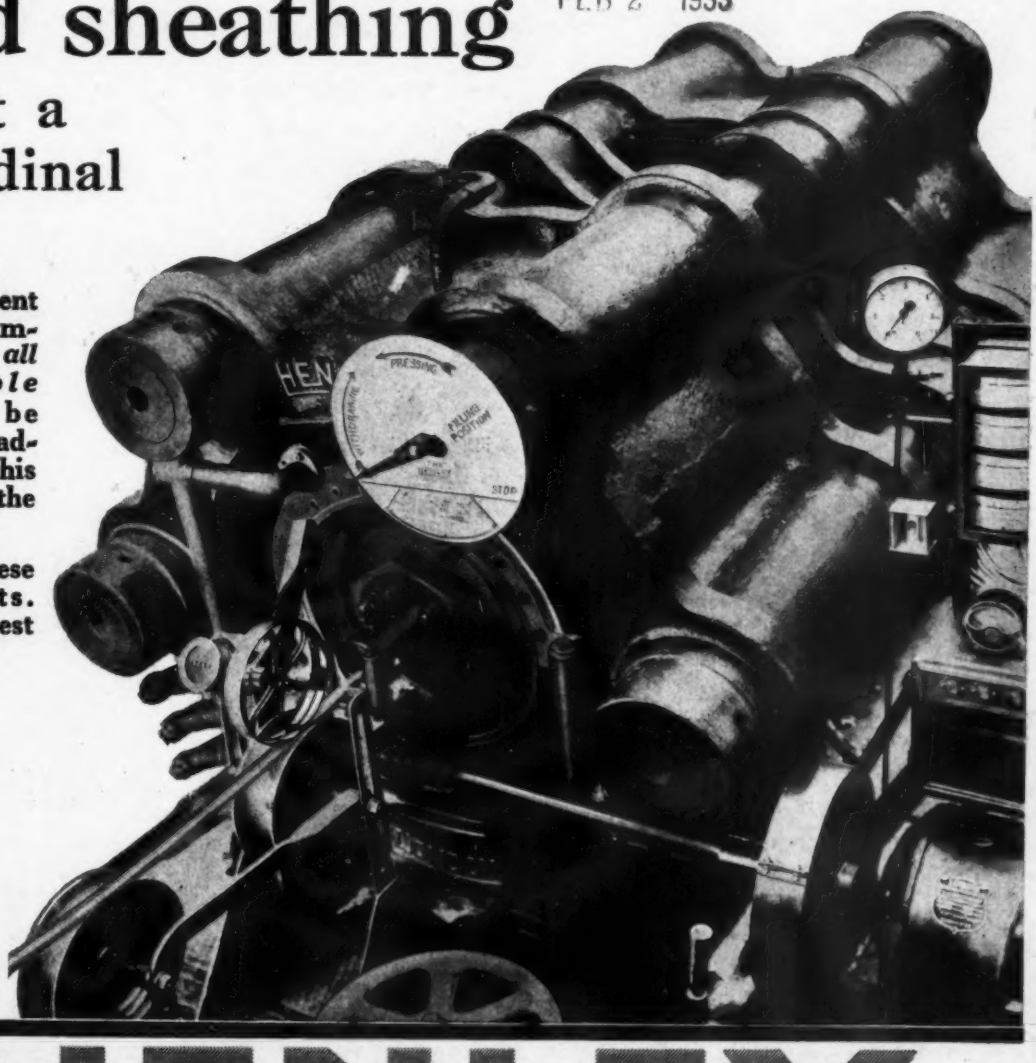

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The
Electrical Review

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Making the Most of the Grid

WE have long since passed the point at which anything of practical value is to be gained by discussing the merits or otherwise of grid interconnection and bulk supplies. The grid is in being, and since the beginning of this month the Central Electricity Board has been a trading concern. We now come down to the "brass tacks" of making it work, and the wise supply engineer will devote his attention to getting the most out of it for his own undertaking. This means considering how prospects are affected by the grid tariff.

It is accepted that low running costs (which amount in all to less than the total fuel costs) follow from generation in large units on selected sites, and the main interest centres in standing charges. Elsewhere in this issue Mr. D. J. Bolton shows from an analysis of present costs that the grid tariff will allow an average reduction of ten per cent. of the kilowatt charges under existing conditions. This is better for the smaller undertakings than might appear at first glance, because an appreciable number of the larger authorities will take supplies at adjusted station cost. More important for future development is the reasonable expectation that this advantage will increase year by year as the load grows.

The reduction in stand-by plant through interconnection will reduce the kilowatt charges, which will be only partly offset by the standing charges on transmission; these include operation costs, since they vary so little with the energy transmitted. Adding the costs of secondary (local) transmission and distribution, which we may expect to increase rapidly in the future, the tendency will be for an undertaking's standing charges to become an ever greater proportion of the whole. We thus approach conditions obtaining in countries dependent upon water power, in which the urgency of providing a return on the principal charges (which remain constant irrespective of output) has often provided as big an incentive to progress as the low running costs of which we hear so much.

A second stimulus is given by the grid tariff through progressive reduction in kilowatt charges with increasing load, which should suitably reward vigorous action by an undertaking in increasing its output.

Full advantage will not be taken of the grid if schemes of local distribution are held up on account of so-called "economy." Apart from the direct and indirect contributions of electricity towards improved industrial conditions, it is foolish to curtail expenditure on work that is necessary for obtaining the biggest return on the outlay on the grid.

It comes down to this: that the supply engineer, who knows that his costs of production cannot be increased, can make the most of the grid only by developing the rate of growth of his output through efficient distributing methods. In this way, too, he will help to bring nearer the time when reductions in the grid tariff will become practicable.

Where Electric Baking Scores

SUPPLY authorities find bakers difficult to wean from the ovens to which they have been accustomed for years, whether the heating agent be coal, coke, oil, gas, or steam. The modern steam-heated oven has many adherents, and undoubtedly is doing excellent work at reasonable cost, although we are not aware of a single attribute of the steam-heated oven which cannot be claimed justly for the electric oven. Before it passes into the obscurity of the files we should like to throw the spot-light for a moment upon a reference in *Vulcan* for the present month. The writer of a note on the failure of a steam-oven tube says that such failures are by no means rare, and that the majority have been caused by over-pressure due to overheating, consequent upon deterioration of the brickwork. Obviously the adoption of electric heating cuts out that risk, with all its possible consequences, and that advantage is added to all the others gained by the "electrified" baker, such as ease and delicacy of control, greater cleanliness,

automatic preheating to a definite temperature, great reduction in maintenance costs, uniformity of product, pleasanter conditions of work, free choice of position, and so on. Baker "prospects" should be pressed, in their own interests, to be frank about the maintenance costs of their ovens over long periods; and, on our side, makers and supply authorities between them should be able to put forward an attractive guarantee.

Electricity and Employment

THERE is a risk that in the present confusion of thought about the causes of unemployment some blame should be attached to electricity. Modern efficiency in production certainly owes much to the increasing use of electricity, but efficiency does not of itself reduce employment. Without electricity the position would be very much worse, and the standard of living and purchasing power would be considerably lower. A report of the International Labour Office mentions, as an important contributory cause of "technological unemployment," the lack of mobility of labour; we have only to think of the electric railways, tramcars, and trolley buses to realise the beneficent influence of electricity in this connection. The possibility of transmitting electricity from sites by the riverside to those most suitable for raw material or markets is a further illustration of its "moving" influence. There are also many important industries that depend on electricity for their very existence, either because electricity is essential to the technical processes or because without it the industry could not be carried on for economic reasons.

Our Suburban Railways

WHATEVER justification there may be for financial caution in connection with main-line electrification, the same considerations do not apply to the conversion of many of our suburban lines. Speaking at the I.E.E. North-Western Centre dinner on Tuesday, Professor Marchant said that there were at least half a dozen suburban railways "crying out for electrification." The time is, as he stated, peculiarly suitable for putting the work in hand. The manufacturers are now almost freed from the work of supplying material for the grid, and there are many first-class engineers needing an outlet for their abilities. What is of even more practical importance is that money is cheap and the cost of material low (copper is only half the price obtaining when the Weir Report was published). It is extremely unlikely that if the Government were to give a guarantee for the necessary loans, as the President suggested, it would ever be required to implement it, in view of the more than satisfactory economic results that have hitherto attended the conversion of suburban lines.

Dangers of Poor Street Lighting

THAT our streets are too inadequately lighted to be safe has long been a commonplace topic among illuminating engineers, but it has been difficult to obtain striking illustrations of its truth. Some statistics given in an address to the American I.E.E. show that in one State fatalities among pedestrians by night and by day are in the ratio of two to one, although 80 per cent. of the motor traffic is in the daytime. Between 5 p.m. and 8 p.m. the increase in the four darkest months was 350 per cent. over the figure for the four lightest months. Rather less than half of the fatalities occur in towns of more than 10,000 inhabitants, with 78 per cent. of the population, the majority being in the smaller towns, with 22 per cent. of the population. In Great Britain not only is low intensity of illumination a danger, the variation in intensity that is found between two adjacent local authorities' areas is sometimes worse.

Electric Milk Vans

FOR the delivery of goods with frequent stops the battery-propelled vehicle is paramount. The Express Dairy Co. has just started to send round its milk to the residents of Holly Lodge Estate, St. Pancras, in electric vehicles in place of horse-drawn vans. The primary objects were to avoid noise and damage to the roads, but we have no doubt that the Dairy Company will secure an adequate economic reward from its enterprise. The strain of frequent starting on steep gradients proved too much for many of the petrol vans tested, and the noise of starting up the engines and of gear changing was also objectionable. Possibly the electrical solution was inspired by the example of the St. Pancras Borough Council, which uses electrically driven dust-collection vehicles.

Contractors and Distribution

IN the course of his nation-wide "campaign" to ensure the loading of the grid, Sir Andrew Duncan attended the annual dinner of the Electrical Contractors' Association on Tuesday evening, and impressed upon the company the urgent necessity of pressing on with the distribution of electricity now that the production arrangements have been completed. In a sense he was preaching to the converted, for the contractor has always been concerned mainly with the distribution side, but we shall not say that his sermon was unnecessary. The industry has been jogging along very nicely for years, but it has become obvious that the pace must be quickened, and the contractors must realise it. National campaigns and exhortations from those at the head of affairs are necessary, no doubt, but the real work has to be done by those in close touch with the public in our towns and countryside. Nobody is nearer to the ultimate user of electricity than the contractor, unless it be the consumers' engineer. If the contractor does not do his bit somebody else will step in, for the work has got to be done. Contractors should, therefore, get together in their various localities (through E.C.A. branches or E.D.A. Circles) and become a real driving force for electrical development—educating the public and forcing laggard supply authorities to provide the cheap and complete service which is *their* job.

Co-operative Advertising

ELECTRICAL contractors and retailers are not, like grocers, engaged in an endeavour to gain for themselves as great a share as possible of a business which has definite limits. The bounds of electrical development will never be reached in this generation, and, indeed, they are ever widening. The contractor's success is very largely dependent upon the education of the public, and he is wise if he realises that playing a lone hand is not the best way of going about it. On several previous occasions we have called attention to praiseworthy combined efforts by local electrical men, and now we have received from the *North Cheshire Herald*, Hyde, Cheshire, a copy of a telling page advertisement produced by local registered contractors (all members of the E.C.A.) with the assistance of the Stalybridge, Hyde, Mossley and Dukinfield Joint Electricity Board. It is illustrated, and covers in an interesting fashion some of the principal applications and attributes of electricity in the home. We would like to see more of these local efforts.

Overwinding

A RECENT accident due to overwinding at a Lancashire colliery in which several lives were lost is the occasion of the issue of a circular (No. 57) by the Mines Department. This states that an expert committee is to be set up for the study of improvements in equipment and practice with a view to preventing such accidents. The primary cause of overwinding is usually a momentary failure of the human element, to provide against which winders in shafts of more than 100 ft. deep are required to be fitted with automatic devices. With old steam-driven equipments the devices employed quite evidently do not always secure speed control that is properly related to the braking capacity of the engine. The investigations of the committee should give prominence to the supreme merits of electricity in all questions of automatic control, and perhaps, also, as we hope, to a fuller appreciation of the value of electric winding engines.

Electrical Contractors and Their Guests

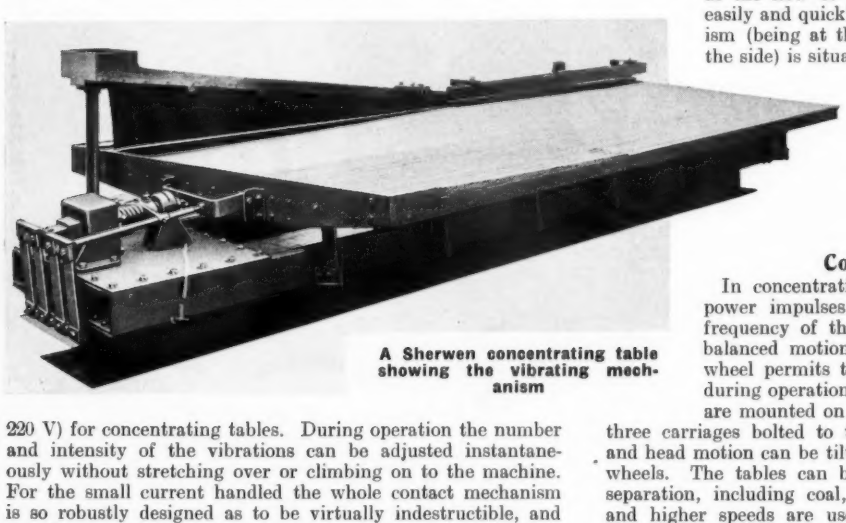
A few of the well-known members of the electrical industry and their friends caught by our artist at the annual dinner of the E.C.A. on Tuesday evening last. A report of the very successful function appears on page 93 of this issue

Electrically Vibrated Screens. By J. Dummlow

AN important advance in the science of mineral separation is marked by the growing use of electrical vibrating mechanism. In one form (Sherwen patents) the deck of the screen or concentrating table is mounted on spring slats of hickory or ash (on the Ferraris principle) and vibrated by means of d.c. solenoids fitted with a simple make-and-break device. Each solenoid consists of a former-wound field coil with a laminated core connected through rods to the moving frame. Platenoid make-and-break contacts of large area are provided, one rigidly fixed and the other mounted on a heavy spring of laminated steel; an oil-immersed condenser is connected across the contacts to reduce the spark and also to act as a regenerative power agent. One solenoid is used on concentrating tables and two on screens. Both solenoids and condensers are contained in heavy cast-iron cases bolted to the back of the fixed frame or undercarriage. The make-and-break is regulated by means of a thumb-screw to obtain the most efficient separation.

Many Advantages

Electrically vibrated screens and concentrating tables are simple in construction, strong and light, and comparatively silent in operation. They are built in compact self-contained units requiring little floor space or headroom, and are easily installed and connected to the supply circuit. The vibrating mechanism is protected from damp so that it need not be placed under cover, and there are no exposed parts to be damaged in handling wet material. The screening efficiency is high, the capacity large, and the power required small—under ¼ h.p. for screens and slightly more (about 1 A at 220 V) for concentrating tables. During operation the number and intensity of the vibrations can be adjusted instantaneously without stretching over or climbing on to the machine. For the small current handled the whole contact mechanism is so robustly designed as to be virtually indestructible, and the vibrator is foolproof. There are no cams, bearings, pulleys, belts or shafts, so that no greasing or oiling is required; little supervision is necessary and repairs are minimised.



A Sherwen concentrating table showing the vibrating mechanism

In screens the fixed frame is made of cast-iron heavy enough to absorb the vibrations and give the maximum screening effect; the moving frame is constructed of light steel, and the whole screen (single deck) weighs about 1,800 lb. There are no projections above or below the screen itself, which can be supported from any suitable overhead structure by hanger rods fitted with helical springs and turnbuckles; enough clearance should be provided to allow for adjustment of the screening angle. The springs act as shock absorbers, preventing vibration being transmitted to the surrounding structures, and the turnbuckles allow the slope of the screen to be adjusted while it is working.

The closeness of grading is regulated by the amount and intensity of the vibrations and by the screening angle. By means of the thumb-screw the speed can be varied from 2,400 to 3,000 single vibrations per minute, and the stroke from 3/16 to 1/32 in.; further variations are obtainable by means of a buffer spring and handwheel and by altering the length of the side rods. The angle can be varied from 20 deg. to 30 deg. to the horizontal, the flatter slopes for close separation and the steeper for large capacities. For close grading two screens in tandem are better than one double deck unit.

The standard screening area is 5 ft. by 3 ft., the whole of which receives intense and rapid vibrations causing the material to move evenly down the screen without bouncing and (in wet screening) with little splashing. The action has marked anti-blinding and stratifying effects, the latter bringing the oversize to the top and causing the undersize to pass rapidly through the openings. Any standard screen cloth may be used, but one with rectangular openings is recommended; no special attachments are needed. Longitudinal side bars on the frame can be adjusted to hold the cloth just tight enough to prevent sagging; drum-tightness distorts the shape of the openings and is liable to tear the wire. The only wear on the cloth is that due to abrasion, which is minimised by the screening action being in the same direction as the flow of the material. Worn cloth can be easily and quickly changed as the vibrating mechanism (being at the back of the screen instead of at the side) is situated well out of the way.

A comprehensive series of works tests has been carried out with these screens on coal, sand, and crushed stone. With meshes of ¼ by 7/16 in. and ⅛ by 7/32 in. coal fed at fifty tons per hour was screened with efficiencies of 94 and 90 per cent. respectively.

Concentrating Tables

In concentrating tables the vibrator causes the power impulses to synchronise with the natural frequency of the table at all speeds, producing a balanced motion and economising power; a handwheel permits the natural frequency to be altered during operation. The cross channels on the chassis are mounted on trunnions, which are supported by three carriages bolted to the foundations; the chassis, deck and head motion can be tilted together by means of two handwheels. The tables can be applied to all kinds of mineral separation, including coal, sand, and slimes; broader decks and higher speeds are used for slimes than for sand, and special waves are formed under the table covering for the initial segregation of the particles. The feed is evenly spread over most of the table, and the water supply can be regulated at any point of the water box.

On a typical slimes table the deck measures about 15 ft. by 5¾ ft., and is given 1,300 single vibrations per minute at ⅜ in. stroke; with sand good results are obtained at 600 to 800 vibrations per minute. The tables run very smoothly at these high speeds, and the outputs are considerably increased.

Electricity in Sugar Factories

THE Empire cane sugar industry appears to be entering upon a period of prosperity, during which some attention will undoubtedly be given to the modernisation of the sugar factory power machinery in the direction of electrification. In the replacement of steam by electricity for the various factory drives, the requirements will be commonplace with the exception of the mill drive. In selecting a mill motor the factors to consider are speed, extent of the load fluctuations, the effort required to start the mill from rest, and the heaviest overload in normal operation. The mill rotates at a constant speed of between two and three revolutions per minute, and gearing must be used. A flywheel effect will be caused by the motor and the driven machinery, which may be of such a capacity as to stall an a.c. machine under an overload beyond its maximum torque, or if the voltage drops appreciably, unless the motor has a larger maximum torque than would normally be required. A synchronous induction motor, which would improve the power factor of the whole factory plant, can be built to start against twice full load torque taking a comparatively small starting current. The effect of the flywheel capacity of the machinery driven would be counteracted by a synchronous machine as, should its speed be reduced due to an overload, it would not stall except when the overload was too large for the rating of the machine, but would continue to run as a slip-ring motor until the overload was removed.

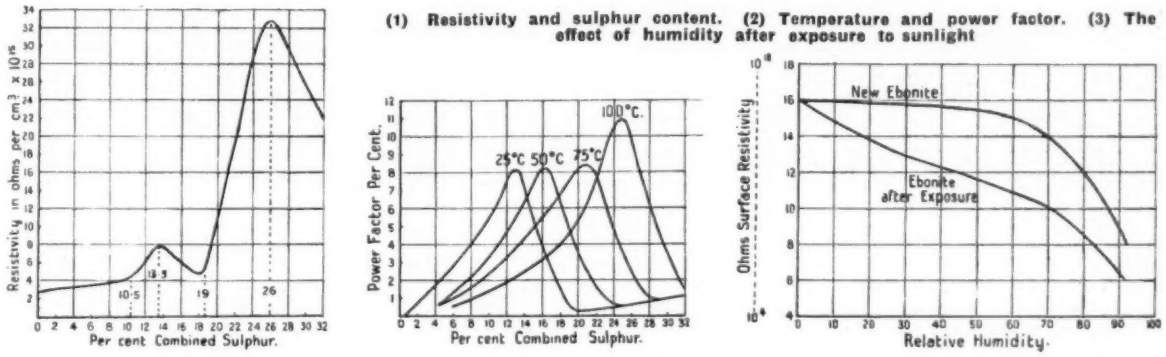
The number of mills (one, two, or three) driven by a single steam engine varies in different factories. There is, apparently, a minimum limit to the spacing between the mills fixed by that which is necessary for the water to diffuse the crushings thoroughly. This distance might be further reduced by modifying the method of water spraying the crushings; this would reduce the cost of the gearing required, effect a saving in floor space, and further the economical advantages of the group drive. If the mills are not spaced too far apart the mills of the three-mill factory could be advantageously driven by a single motor, although if the power required for each mill is considerable an outsize motor may be necessary which, together with the gearing, may not show any advantage in first cost over three separate motor drives. For a four-mill factory one motor may drive two mills, the two motors required being of the same rating, this facilitating interchange. Any considerable fluctuation of the mill load may cause an oscillation of the motor current which may be troublesome with group drive.—T. WILLIAMS, A.M.I.E.E. (Mauritius).

Ebonite. By F. A. Middleton

The nature and properties of an important electrical material

THE approach to the subject of ebonite and its electrical properties is strewn with obstacles which are only just beginning to be removed rather than circumvented. In the first place, there has existed a lack of co-ordination between the rubber and electrical industries in the matter of research into these properties, which has been due largely to the reluctance of ebonite manufacturers to disclose the compositions of the diverse grades they supply. As a result, much of the arduous research work of electrical technicians has been nullified in the past, for many of the properties which they have investigated have been due to the incorporation of filling materials, quite alterable in character and proportion at the will of the manufacturer, and in no way representative of hard rubber as such. Secondly, the mechanism of vulcanisation presents a number of apparently irreconcilable features, upon the elucidation of which must attend a full understanding of the behaviour of ebonite under electrical stresses.

(1) Resistivity and sulphur content. (2) Temperature and power factor. (3) The effect of humidity after exposure to sunlight



The term "ebonite" covers a large class of compounds produced by heating mixtures of rubber and sulphur, in proportions that may vary between one part sulphur to two of rubber, and one of sulphur to eight of rubber. With the sulphur may be incorporated quantities of mineral fillers, accelerators of vulcanisation, and other materials for specific purposes. The effects upon electrical characteristics of these ingredients do not appear to have been studied in any systematic manner, but work with pure rubber-sulphur mixes, ranging from 2 per cent. of sulphur (when vulcanisation produces "soft" rubber) to 32 per cent. (which is the saturation-point of the rubber hydro-carbon for sulphur corresponding to the formula C_5H_8S) has revealed many interesting phenomena, which may assist, eventually, in an understanding of the structure of rubber.

Theories of the Rubber-sulphur Reaction

Curtis, MacPherson and Scott (U.S. Bureau of Standards, Scientific Paper No. 560), concluded that the incorporation of increasing proportions of sulphur resulted in the formation of a succession of definite chemical compounds. They found abrupt changes occurring in physical, chemical, or electrical properties when the percentages of sulphur were, respectively, 10.5, 13.5, 19, and 26. These proportions correspond to compounds of the following empirical formulæ: $(C_5H_8)_4S$, $(C_5H_8)_3S$, $(C_5H_8)_2S$, and $(C_5H_8)_4S_3$. A striking illustration of this is the resistivity curve shown.

The later researches of Boggs and Blake ("Ind. Eng. Chem." 1930, No. 22, p. 748), while perhaps allowing that the union between rubber and sulphur may be a trifle more marked in these proportions, disposes of the concept of well-defined chemical compounds and introduces a theory based upon what is known as the "dipole theory" of Debye.

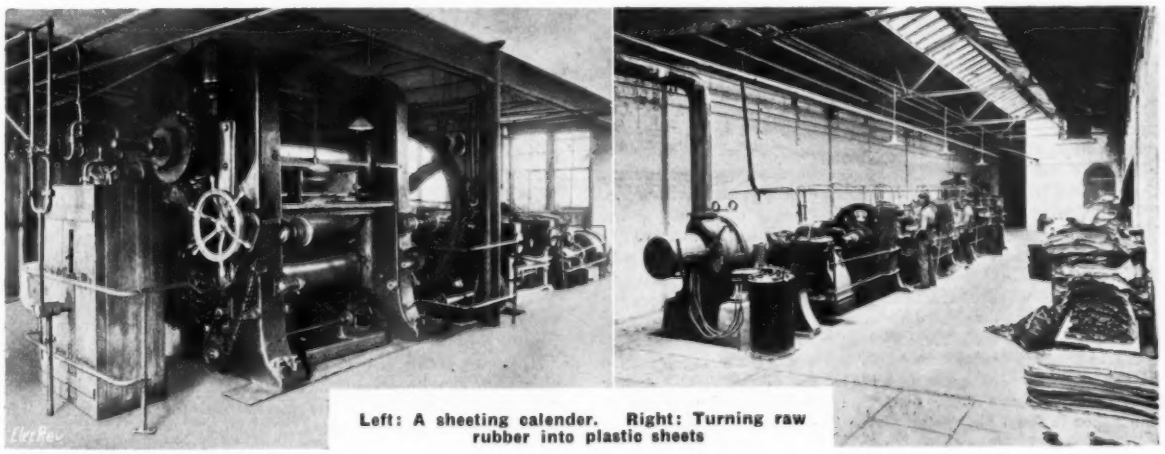
Briefly, the dipole theory envisages molecules as being either electrically symmetrical or asymmetrical. In an electric field the asymmetric ones tend to orient in the direction of the field, and, if subjected to an alternating field, will follow the periodic changes by changing direction at each alternation. The force opposing this orientation depends upon the viscosity of the medium; if viscosity is increased, there comes a point at which the molecules are unable to follow the changes, and can only be re-oriented by lowering the frequency.

It is held that the power factor of a dipolar material is attributable to the frictional losses due to the rotation of the dipoles within the viscous medium, and this is experimentally justified by the fact that as viscosity is progressively increased (*e.g.*, by lowering the temperature) power factor at first rises, and then suddenly falls as the motion of the dipoles is arrested.

Any changes which make molecular structure less symmetrical chemically increase the dipolar moment (that is, increase the electrical asymmetry) and a non-dipolar substance may be converted into a dipolar one by interfering with its chemical stability. The theory of Boggs and Blake was that crude rubber and soft vulcanised rubber are non-dipolar, and that the stability of the latter is progressively upset by additions of sulphur, attaining a maximum dipolar moment (as illustrated by dielectric constant and power factor) when the molecule is half saturated, then falling off with further additions until a stable non-dipolar substance, as represented by the formula C_5H_8S, is again reached. This is only observable when the temperature is sufficiently high to reduce the viscosity so that the dipoles may rotate. The graph showing the effect of temperature on power factor indicates that the dipolar rotation stops at the points of maximum power loss.

Recent Research

The figures relating to the results of these workers supported this assumption quite satisfactorily, but the more recent work of Kitchen ("Ind. Eng. Chem.", 1932, No. 24, p. 549) throws some doubt upon this aspect of the subject, revealing irrelevancies when the same tests are conducted at different frequencies; whereas the previous workers employed a frequency of 1,000 cycles, Kitchen investigated the effect of a whole range from audio-frequency (600 cycles) to radio-



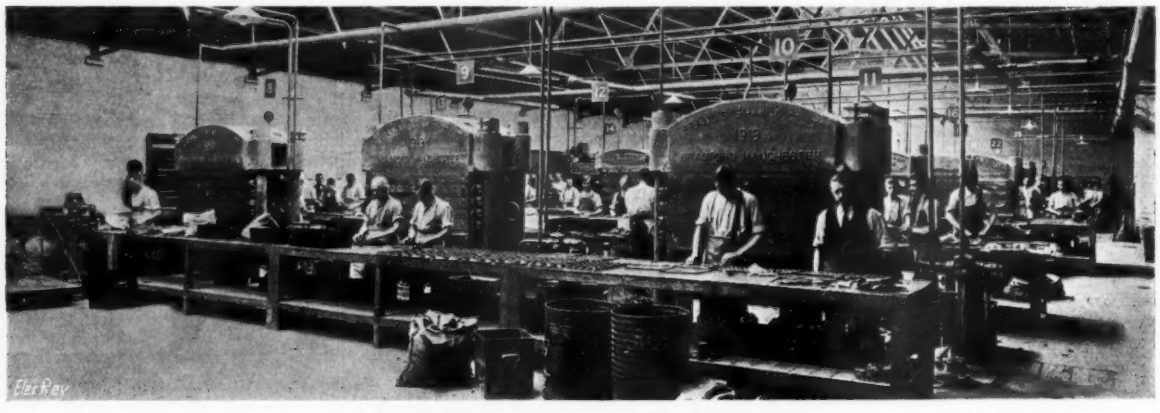
Left: A sheeting calender. Right: Turning raw rubber into plastic sheets

frequency (2,000,000 cycles). He concluded that, although the results do not definitely disprove the dipole theory for rubber, the mechanism is more complex than this, for the molecules seem to be widely varying in their ability to respond to an electric field, since the rubber does not change continuously with increasing amounts of sulphur, but passes rather abruptly from the soft to the hard state when sufficient sulphur (the exact amount depending upon temperature) has been added.

Strength is lent to this conception by the discovery that hard rubber is not electrically neutral as has been supposed; nor yet on the other hand, is it a complete electret (which is the electrostatic analogue of a permanent magnet), but a sort of quasi-electret, which is capable of retaining a charge for some twenty-four hours at room temperature. Whether it can be made to retain the charge for longer periods by lowering the temperature has not been investigated apparently; nor is there any evidence to suppose that there is some limiting temperature at which hard rubber assumes the properties of an electret proper, although this is worth investigating.

As I have indicated, commercial ebonite involves the use of substances which may nullify—or at least alter—its electrical properties, and chief amongst these are mineral fillers which greatly affect resistivity under working conditions. For example, an increase in humidity of 40 per cent. will reduce the resistivity of a loaded hard rubber many *millions* of times, as the joint result of the formation of a microscopically thin layer of moisture, and sun-accelerated oxidation, with consequent hydrolysis, of the sulphur present. The metallic element in the filler reacts to form a sulphate, which provides a low-resistance path along the entire exposed surface. The third graph provides adequate evidence of the importance of sunlight in this deterioration.

Messrs. Redfern's Rubber Works, Ltd., have kindly supplied the photographs illustrating this article.

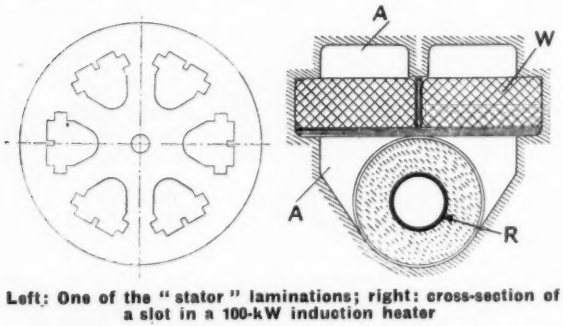


Vulcanising and moulding in an ebonite works

An Induction Heater for Liquids and Gases

A NEW application of induction heating at ordinary frequencies of supply is described by Oskar Neiss in a recent issue of *Elektrotechnische Zeitschrift*. The furnace employed is built on the principle of a three-phase induction motor, the stator of which is built up from punchings and provided with a three-phase winding which produces a rotating field. The secondary consists of an elongated "squirrel-cage" formed by tubes welded or screwed into short-circuiting flanges at each end.

In the horizontal cross-section through one of the slots of a 100-kW heater for 1,000-V, 3-ph., 50-cycle primary supply, W represents the primary windings, R the secondary, and A the spaces through which cooling air is driven. In a two-pole, three-phase arrangement there are six secondary tubes R, the length of each of which may be ten times the height of the stack of stator laminations. Lagging is applied to the tubes to reduce the radiation and convection losses.



Left: One of the "stator" laminations; right: cross-section of a slot in a 100-kW induction heater

Most of the heat developed by the induced current flowing through the tubes is communicated to fluid circulating therein. The thickness of lagging on the tubes may be about 1½ in. in the slots and more outside the core. An important advantage of the squirrel-cage construction for the secondary, constituting the actual heater, is that the tubes can be changed as required to suit different materials without disturbing the primary or its connections. The height of the core is only about 12 in. for a 100-kW heater; hence there is no difficulty in keeping the primary cool, even when the temperature of the secondary tubes is as high as 600 deg. C. The power factor ranges from 0.925 to 0.85, according as the length of the tubes is from six to ten times the height of the core.

Compared with ordinary resistor heaters, the induction heater offers the advantages of being directly applicable to high-voltage supply and of having heating elements which are electrically isolated from the supply. Fluid in the tubes is heated by direct conduction without intermediate transmission. As the temperature of the whole tube surface is uniform, there is no local overheating of the charge. The amount of heat stored in the heating tubes is relatively small, hence the apparatus responds almost instantly to control.

An Actual Installation

The author describes a heater of this type installed by the Harburger Olwerke Brinckmann u. Mergell, Harburg-Wilhelmsburg, for the treatment of vegetable oil. Each of two boilers contains about three tons of oil which has to be subjected to treatment for four hours. The oil is raised to a temperature of 180 deg. C. by steam coils inside the boilers and is then further heated to about 240 deg. C. by pumping mineral oil through two 100-kW induction heaters and jackets round the boilers. The heating oil is circulated at the rate of 5,280 gal. per hour, corresponding to a velocity of about 6½ ft. per sec. through the induction heater tubes. The maximum temperature of the heating oil is 300 deg. C. and that of the tubes 335 deg. C. If resistance-wound tubes were to be operated with the same temperature gradient about four times the tube surface would be required. With a mean temperature difference of 37 deg. C. between the heater inlet and outlet, the specific loading of the tube surface is 16 kg. cal. per hour per sq. dcm. per deg. C. (328 B.th.u. per hour per sq. ft. per deg. F.).

The tube systems of the two heaters are mechanically in series. Interlocking is provided to prevent the main switch being closed unless the cooling fan and oil-circulating pump are in action. Maximum temperature cut-outs are provided: and one of the induction heaters has star-delta switching (3:1 regulation) and an induction regulator ± 15 per cent. voltage or about 2:1 power regulation), giving continuous control between 16 and 33 kW and between 50 and 100 kW. Tests show the thermal efficiency of this installation to be 69 per cent., allowing for all losses, which are approximately as follows: electrical losses, including auxiliaries, 4.5 per cent.; radiation from induction heater, 5.5 per cent.; loss from pipes leading to boiler, 5.5 per cent.; boiler radiation, 15.5 per cent. The power factor is 0.85 at full load. If required, heaters of this type can be operated at temperatures up to 600 deg. C. without difficulty, and the mechanical form is suitable for application to high pressures.

Some Municipal Electrical Engineers

From left to right: Mr. W. E. Richardson, Aberdare; Mr. Dawson Thomas, Abertillery (*Elliott & Fry*); Mr. C. G. Morley New, Cardiff (*Elliott & Fry*), and Mr. J. M. Bowman, Rhondda (*Whitlock & Sons*)

Power Station Oils. By E. A. Evans

The need for further research

I HAVE heard it said that power station oils have been discussed so exhaustively that so hackneyed a subject cannot interest anybody connected with a power station. But is this really true or even justified? Transformer and switch oils have been studied by members of the British Electrical & Allied Industries Research Association in very great detail, and yet research continues. It continues its scientific work to satisfy the demands of the electrical industry—to grapple with problems of immediate practical importance, and not merely to satisfy the lust of the academic worker. The money for these researches is provided by business men who presumably hope to utilise the results of the scientific workers for some ultimate reward to the electrical industry as a whole. Whilst these investigations are incomplete there must be an anticipation, a hope, and an interest.

The British Standard Specification for Transformer and Switch Oils was published in 1924. Progress followed, and in 1927 it was revised and brought up to late. Since then no revision has been published; the last revision is due for further consideration. It is well known that the diagram of the sludge test is more diagrammatic than correct. Nobody would use a capillary as depicted. The specification of the petroleum spirit used to precipitate the sludge leaves something to be desired, and experience has shown that the glass from which the flask is made should be more definitely described if irregularities are to be avoided.

Experimental errors have brought adverse criticisms upon the sludge test, yet in England we are not inclined to depart from it. The German test has been shown to give results of doubtful significance; the American life test is too long and too susceptible to conditions to be popular; and the Swedish test, which makes use of high voltage, is somewhat awesome to the mere chemist. Engineers as well as chemists have difficulties to surmount; differences of opinion often occur with regard to the question of breakdown values, differences which cannot be attributed to sampling.

[*Elliott & Fry*

Mr. E. A. Evans is Chief Chemist to Messrs. C. C. Wakefield & Co., Ltd.

The Cold Test

The B.S. Specification No. 184/1927 includes six different oils which are denominated A.0, A.10, A.30, B.0, B.10, and B.30. The numbers 0, 10 and 30 represent 0°, −10° and −30° C., the temperatures at which the oils cease to flow when exposed to prescribed conditions which are given in the appendix to the specification. The cold test does not, nor pretend to, indicate the temperature at which the oil cannot be pumped, or circulate under thermo-syphonic conditions, nor yet be poured from a barrel. Practical experience has proved that the test is useful, easily conducted and reasonably reliable. Experience has also shown that oils with a high cold test are dangerous both in a transformer and in a switch where there is the slightest risk of the oil solidifying or becoming too viscous to flow. It is surprising to find engineers who take a risk; most engineers prefer safety first and use oils A.30 and B.30—but some do not!

The British Standards Institution has given several years' consideration to turbine oils, and has finally agreed to issue specifications. Some may think that it has had time in which to come to a conclusion upon such a simple subject, but assumptions as to its simplicity are entirely unwarranted. Agreement about viscosity was readily arrived at due to the fact that the several makers of turbines had crystallised ideas upon the subject. In the past, standards of demulsification value have been based upon what the oil supplier was content to give, rather than what he could give. Improved methods of refining have encouraged the engineer to demand oils of better demulsification value and in some cases perhaps the demand has become a little extortionate. Does the oil remain for long in service in such a state of freedom from emulsifying bodies? Does an oil of such a character necessarily remain unchanged for a longer period than one of slightly worse demulsification value? These questions, apart from their practical utility, are of economic interest to the users of oils.

Viscosity and Deterioration

Almost without exception turbine oils do deteriorate in demulsification value in use. In many cases the deterioration progresses to a definite limit and stops. The degree of deterioration is normally governed by the viscosity of the oil; in general the higher the viscosity of the oil the greater will be the deterioration. A poor demulsification value theoretically indicates a grave risk if water should get into the oil. Water can enter as a small globule, which is immediately carried on unmolested to the settling tank; it may enter with a sudden rush, and even reach the oil reservoir without rising to the suction pipe, and in this case it is probably harmless. If the oil and water can be intimately mixed the risks are apparent. Engineers will tell us whether this risk often arises in sets which are properly cared for, and from which the water is systematically withdrawn.

Turbine oils are subject to fantasies and fashions. It became fashionable to talk about acidity a few years ago, presumably because there were legitimate reasons at that time to take precautions. Unfortunately, however, it became a little overdone through nervousness; the only people who really gained were the oil companies! Our ideas on the maximum acidity allowable are still very nebulous and we know comparatively little about corrosion risks because they are so rare. The only other risk of importance, so far as we know, is the formation of soaps if boiler-water solids prime and find their way into the oil. For many years the Admiralty seemed to be the only buyer of turbine oil who worried about sulphur content. Suddenly, almost without apparent premeditation, sulphur became prominent, and now a war rages over it. It has arisen because oils are becoming available from which the refiners are not anxious to expend money in extracting the sulphur. If it is harmless why should they?

These notes, I hope, indicate that the subject of power station oils is still one for further discussion and enlightenment.

Fabrication by Welding. By E. Dacre Lacy

Some typical examples from electrical factories

ELECTRIC arc welding has long been used for repair work and for remedying small defects in castings, but within the last four years or so the process has also been greatly used in the fabrication of machines. The advantages of welding over casting are several. For instance, the metal used in a welded structure is always rolled steel, which has a greater ultimate strength than cast iron, and the reduced size of the members gives lightness to the fabricated part.

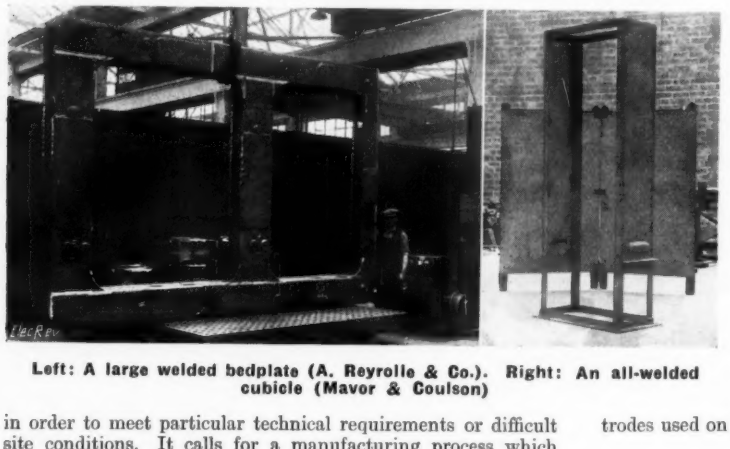
The use of electric arc welding has extended more among firms in the electrical industry than in others, as these have been in closer touch with welding developments than other engineering concerns, which do not yet realise how wide is its field of application. During the last few months I have visited some of the most important engineering firms in the country to ascertain the uses they are making of electric arc welding as a means of fabrication, and have compiled the following notes on progress in the works of a few of the well-known electrical manufacturers.

In a Switchgear Works

Fabricated welded steel plays a very important part in the manufacture of switchgear at the works of Messrs. A. Reyrolle & Co., Ltd., where upwards of eighty welders are regularly employed. The whole of the welding department is equipped with single-operator welding sets manufactured by the company. Circuit-breaker tanks, frame brackets, dividing boxes, bed plates, stator frames, transformer tanks and all-steel casings, where electrical gear has to be oil immersed, are fabricated by welding. Welding jigs are used for the assembling of details on standard production work, and all special work is set up and tacked on surface tables; only a minimum allowance, varying from 1/32 in. to ⅛ in., according to the size of the job, is allowed for machining.

Welded steel-frame brackets have superseded the cast-iron frame brackets on all types of gear manufactured by the company. They are about 50 per cent. lighter, cost less, are much stronger, and stand up to heavy work much better; breakages are eliminated. Jigs are used for the quick assembly of details. The circuit-breaker tanks are constructed to withstand high working pressures. They are completely welded, and each layer of weld metal is inspected before it is covered up; the completed work is stamped with the operator's mark, so that any faulty work can be traced to the welder. Steel bedplates also are electrically welded, the largest of these weighing approximately 2½ tons.

In switchgear engineering, special equipments have often to be designed and manufactured, singly or in small numbers,



Left: A large welded bedplate (A. Reyrolle & Co.). Right: An all-welded cubicle (Mavor & Coulson)

in order to meet particular technical requirements or difficult site conditions. It calls for a manufacturing process which is flexible and involves the minimum expenditure on any tool that is unlikely to be useful on future work.

A Means of Reducing Cost

Industrial switchgear has to be inexpensive, capable of rough usage by possibly unskilled labour, oil-tight, and should be compact. The growth of large power stations and the conditions which result from the grid network have caused a steady increase in the size and weight of main switchgear, resulting in high building and other costs. Efforts are continually being made to keep the dimensions and weight of main station switchgear as low as possible, without sacrificing robustness and reliability. These conditions are met to the greatest degree by fabrication by arc welding.

Messrs. Ferguson, Pailin, Ltd., possess an up-to-date mechanical testing house. All complete circuit-breaker tanks and top plates are subjected to a routine hydraulic test in order to reveal any possible defect in material or welding. A number of cases of faulty castings have been revealed under test, but instances of defective fabrication are extremely rare. A considerable number of 132-kV outdoor oil circuit breakers have been manufactured for the North-West England section of the grid, and on this large gear fabrication also has played a considerable part. All operating mechanisms of the breakers are mounted in fabricated kiosks, and require only to be bolted down and connected up on site.

Recently an inquiry has been received by Messrs. Mavor and Coulson, Ltd., from one of our colonies for street cubicles

Welding an oil circuit breaker at the Ferguson, Pailin works

to house electrical switchgear. As no definite specification was given, it was decided to manufacture these cubicles by electric arc welding. The estimated cost of an all-welded structure in mild steel was much less than one made of cast iron.

A Welded Street Box

From the finished drawings the jigs and fixtures were designed and the sequence of operations was drawn up. It was necessary for one of the cubicles to be completed and passed before the remainder of the order was proceeded with. These cubicles are about 8 ft. high and measure 2 ft. 7 in. by 1 ft. 4 in.

The structure consists essentially of four angle-iron uprights which are welded to top and bottom angle frames, the lower frame to sit on brickwork and the upper one to carry the domed top. These frames consist of angles cropped to mitre at the corners and are welded. All holes were punched to template and welded in fixtures which had registers for the holes and were interchangeable.

The front and back doors consist of panels 2 ft. 7 in. by 6 ft. 6½ in. by ⅛ in. thick, and in order to stiffen them a cope previously bent in a jig was registered in position and spot-welded. This was the most difficult part of the whole job. The panels assumed all kinds of shapes during the spot-welding and had to be flattened by hand afterwards. All the electrodes used on the job were Murex " Standard."

Classes for Stokers

The National Smoke Abatement Society has decided to co-ordinate the various courses for the training of stokers and boilermen held in different parts of the country, and to issue a national certificate for proficiency. The Society is to convene a conference of regional smoke abatement committees to work out the details of the scheme, which it is hoped will bring in technical schools and other training centres. Mr. Arnold Marsh, secretary of the Society, says that a great diminution of smoke could be achieved by the employment of more highly trained stokers. Training classes are now held and certificates issued in many centres, but these often have only local value, and it is believed that co-ordinated classes and a national certificate would be much more valuable. Many employers look upon stoking as a labourer's work, whereas it is an important factor in keeping down production costs.

What the Grid will Save. By D. J. Bolton

A profit and loss account

THE grid tariff for Mid-East England became operative on January 1st. It is now possible to make a first estimate both of what the national scheme has cost and what it will save the supply industry. The basis of comparison will be the Engineering and Financial Returns of the Electricity Commissioners, a further volume of which was published in September. This covered the period ended December 31st, 1930, for the companies, and March-May, 1931, in the case of the local authorities. There are now eleven years for which full data are available.

There are two difficulties in comparing the generation costs as given in the Returns and the grid tariff as now published. One is that there is a gap of nearly three years to be spanned, and during this period all costs and prices have been varying continuously; the most satisfactory method in such a case is to plot the available figures to a time base and continue the curves as faithfully as possible. The second difficulty is that the costs are given as simple aggregates, whilst the tariff is a two-part one. Such a difficulty can be overcome either by segregating the costs on a two-part basis or by combining the tariff for a particular load factor. The former method gives the greater amount of information, but both methods are useful and both will be employed here.

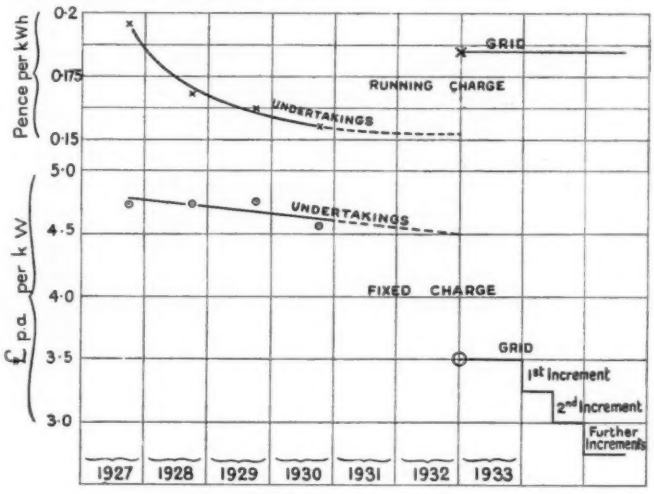


Fig. 1

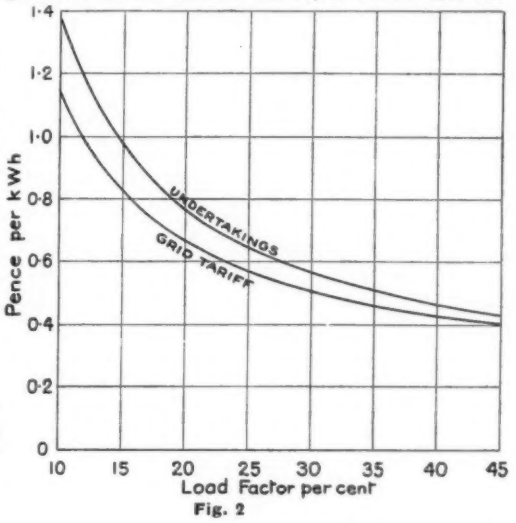


Fig. 2

The Allocation of Costs

The first step in segregating the costs is to deal with the working expenses of generation (fuel, wages, &c.). Aggregate figures are given in the Commissioners' Returns for the stations of authorised undertakings, and these can be allocated to fixed and running costs in accordance with the scheme laid down for selected stations. Thus in the case of fuel the total expenses in 1930 amounted to £7.06 million, and the proportion of this which is to be allocated to fixed costs is $\frac{100}{100+12.8L}$ where L is the load factor per cent. Now the mean load factor on the generating stations was 33 per cent., and putting in this figure gives 100/522=0.19, which multiplied by 7.06 gives £1.35 million for fixed costs. A similar procedure is followed in the case of the other three groups of generation costs, namely wages, repairs, and oil, stores, &c. The fraction is different in each case, there being a much higher allocation to fixed costs in the cases of wages and repairs.

Next come management, rents, rates and taxes. These can be regarded as wholly fixed costs, but they are incurred on account of the undertaking as a whole, not merely on account of generation. In the present analysis they have been divided into two portions for generation and for transmission and distribution in the ratio of the corresponding capital expenditures under these two heads.

Capital charges and other disbursements are mainly the unavoidable payments on account of interest, depreciation and sinking fund for loan redemption. In addition they include a certain amount of distribution in the form of profits, relief of rates, &c. The latter do not amount to very much, and the whole may be regarded as proportional to, and as a payment for, capital investment. The total surplus of receipts over working expenses thus amounted to 7.50 per cent. of the whole capital expenditure. (For the present purpose the receipts from, and expenses of, bulk supplies are omitted from the two sides of the balance sheet.) Taking this percentage and multiplying it by the capital expenditure on account of generation, we obtain the " capital charges " for generation.

The aggregate maximum demand on the generating stations of authorised undertakings amounted to 3.80 million kW. The sum of the individual m.d.s of all consumers or feeders would of course be somewhat greater than this, since these m.d.s would not exactly synchronise. Taking a diversity factor of 1.15 the calculation for fixed charge at the generating stations is as shown in the table.

To obtain the kWh charge at the station it is necessary to take account of all the expense proportions not included above. Thus since 19 per cent. of the fuel is taken as a fixed cost the remaining 81 per cent. is a running expense. Similarly with the appropriate proportions of wages, repairs, stores, &c. The sum of these figures then gives the required numerator. The kWh generated in the stations was 10,947 million and subtracting the energy used on works (approximately 6 per cent.) the difference gives the required denominator. The quotient of these two gives the kWh price at the station.

FIXED COSTS.	£ million.
19% of fuel	1.35
89% of salaries and wages	2.03
77% of repairs and maintenance	1.45
24% of oil, water and stores	0.07
Management, rent, rates and taxes for generation	4.37
Capital charges for generation	10.68
Total	19.95

$$\text{Fixed charge} = \frac{19.95}{3.80 \times 1.15} = £4\ 11\text{s. per kW per annum.}$$

RUNNING COSTS.	£ million
81% of fuel	5.71
Remaining percentages of other items	0.89
Total	6.60
kWh generated, million	10,947
kWh used on works, million	6,672
Net total	10,275

$$\text{Running charge} = \frac{6.60 \times 240}{10{,}275} = 0.155\text{d. per kWh.}$$

The loss due to the kWh used on works is taken as a running cost. Strictly this should be allocated between fixed and running charges, since much of it will be for operating auxiliaries and largely independent of the kWh generated. However, since it is not a large item and no data is available it is allocated entirely as shown.

Mean Costs of Production

The final result is a two-part price representing the mean cost of production at stations of authorised undertakings, and including all financial charges and disbursements. This is of such a form that it can be compared with the published grid tariff.

This procedure has been carried out for three separate years terminating December 31st, 1930, or May 15th, 1931. These are here referred to as 1928, 1929, and 1930, respectively; the costs are taken as centred at September 30th in each year, and are shown plotted in fig. 1. The fixed costs fell very slightly, whilst the running costs fell more noticeably but with a diminishing tendency. This might have been expected, as

costs in general fell slightly in the period 1927-30, but some items, *e.g.*, rates, were rising rather than falling. In the meantime thermal efficiencies were improving so that even with a fixed fuel price the running costs would decrease, but this tendency inevitably tends to a saturation point.

The curves are continued by dotted lines to show anticipated costs up to the beginning of this year. The fixed component is taken as a straight line with a slight drop whilst the running component is a falling curve gradually flattening out.

Comparison with the Grid Tariff

The final result is a price of £4 10s. per annum per kW, plus 0.153d. per kWh. This may be compared with a grid tariff commencing in 1933 of £3 10s. plus 0.186d. It might be anticipated that the costs figure for the undertakings would continue to decrease slightly after 1933. Against this may be put the quotation in the grid tariff of three successive reductions in the fixed charge for given increments above the 1933 demand. These are shown graphically in fig. 1 (bottom right); in the case of very large consumers an increase of only 5 per cent. is charged for at a cheaper rate.

How the grid tariff will compare with the station costs depends of course on load factor. At all points the grid is cheaper, and the lower the load factor the greater will be the extent of the reduction. In fig. 2 the overall price in pence per kWh is plotted for the two sets of figures to a base of load factor for the range from 10 to 45 per cent. Even at 100 per cent. load factor the grid price is still about 5 per cent. cheaper than the other. From these curves it is possible to see how the two compare at the mean load factor. Since the aggregate load factor on the stations is 33 per cent., and assuming a diversity factor (1.15) as before, the load factor of the average consumer or line taking from the station busbars will be 33/1.15=29 per cent. At this load factor the undertakings' mean price in 1933 would be exactly 11 per cent. higher than the grid price.

These results may seem disappointing to those who expected something immediate and startling as a result of the Central Board's activities. Others, on the other hand, have queried whether the grid can possibly pay for itself at a price which will compete with existing undertakings. Although many small sets and stations still exist (the " average " size of a.c. sets in 1930 was 5,600 kW) the larger sets are used so much more basically that the " average unit " is already generated by a relatively large and efficient set. Actually 57 per cent. of the installed capacity was in sets of 10,000 kW or larger, and probably it would be found that three-quarters of the total energy generated was by sets of this size.

In fact, the results of the comparison are very much what could be anticipated. One aim of the grid is admittedly to concentrate generation at the most efficient stations and to the most efficient steam raising and generation sets, and this should reduce running costs. But since generation under the old regime took place largely at the centres of gravity of the loads, any interference with this will inevitably add to the net amount of energy transference and so increase the units lost in transmission. Hence the grid tariff running charge is higher than the mean for the existing undertakings, since their cost figures employed above include no transmission and are merely station busbar prices.

The chief aim of the grid (and the sole gain to appear in the tariff) is the reduction of the fixed costs of generation by the better utilisation of capital investment and the reduction of standby requirements. That is why it is the kilowatt charge that feels the benefit, and as the country's total load grows this advantage should become progressively greater.

Certain considerations have necessarily been omitted from the present brief survey. The power factor on which the grid tariff is based is 0.85 and any lower figure incurs a penalty on the fixed charge. The costs of authorised undertakings are given in terms of kW only, and data is not available for assessing the existing power factor, but it may be doubted whether *at the time of maximum demand* this is lower than the above figure.

Primary Transmission Costs

Another cogent point concerns the primary transmission costs. The costs of transforming up for this purpose (not included in the undertakings' figures above) would be saved by taking a grid supply, but in some cases there might be additional costs for transforming down. Still more transmission costs may be saved by taking supplies at more than one point, and although a service charge is made for such additional points probably the price will be considerably less than that at which the undertakings themselves could do it. The grid in this case will have the advantage of the space diversity between the different loads to be transmitted.

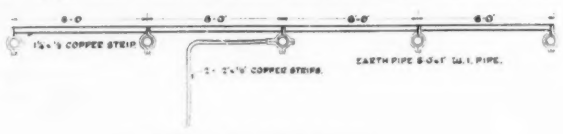
The final conclusion, then, is that the grid tariff represents a ten per cent. reduction on the average cost under existing conditions. Moreover, this average includes a number of very good stations which will be able to generate more cheaply and will therefore be off the tariff. The achievement of the Central Board should therefore be compared not with the general average but with the lower levels of existing undertakings, on which it is an unquestioned improvement.

A Method of Solid Earthing

THIS article describes the method adopted for measuring the resistance of an earthing system for a group of two three-phase 1,500-kVA transformers installed at a cement works.

The subsoil consisted of hard chalk, which has a high resistivity. In view of the unreliability of ordinary earth plates and the cost of excavation a multiple earthing system was employed, consisting of a number of galvanised wrought iron pipes driven into the ground at intervals of 6 ft. and connected together by means of bare copper strip. This method has the advantage that should the desired resistance figure not be obtained the installation can be extended at very little extra cost.

In the arrangement finally evolved the pipes were made 8 ft. long in order to avoid as far as possible seasonal changes in the resistance. Each electrode consisted of 1-in. galvanised w.i. pipe with a driving spike and was fitted with a cap in



Plan of final earthing system

order to prevent damage to the pipes when being driven into the ground. I would stress the importance of a long taper on the driving spike where hard ground is likely to be met. The connection at each pipe was made by means of a galvanised clamp, enclosed in a wood box filled with compound to prevent corrosion. The copper connections were laid in a shallow trench with a slight wave to avoid strain on the clamps due to variations in temperature.

The field test was based on the usual fall of potential method employing a form of Wheatstone bridge, balance being found by the annulment of sound instead of the visual observation of a galvanometer. The testing current was obtained from a battery-operated hummer giving an a.c. of 800 cycles per second. For the auxiliary earths two 2 ft. by ⅝ in. diameter copper rods, A and B in the diagram of the earth testing equipment, were driven to a depth of about 1 ft. 8 in.

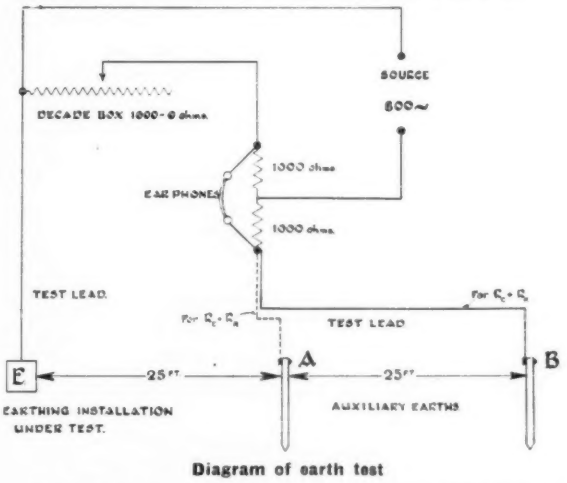


Diagram of earth test

The resistance value of the earthing system (RE) was obtained by ascertaining the values of (R_E+R_A), (R_E+R_B), and (R_A+R_B), where R_A and R_B are the resistances of the auxiliary earths. These values in ohms were 94.3, 100, and 182, respectively.

$$(R_E + R_B) - (R_A + R_B) = R_E - R_A = -82$$

$$\text{and, } (R_E - R_A) + (R_E + R_A) = 2R_E = 12.3$$

$$\text{therefore } R_E = 6.15 \text{ ohms.}$$

As this figure was too high for the automatic circuit-breaker setting, the earthing installation was treated with salt solution with satisfactory results.—C. ERIC STEWART.

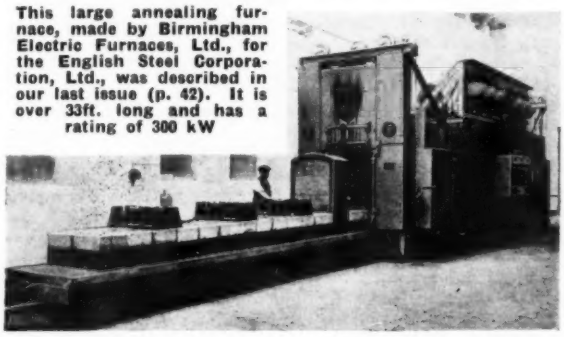
MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

Bypath Automatic Telephony

THIS new method is the result of research undertaken by Standard Telephones and Cables, Ltd., with a view to introducing economies in initial cost and maintenance charges of, and the incorporation of new facilities in, existing methods of automatic telephone switching.

A paper which Messrs. J. H. E. Baker and E. P. G. Wright read on the subject at the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 19th (which was illustrated with a cinematograph film) explains that, like others, the bypath system comprises a number of selecting stages, each of which, however, consists of two portions known respectively as paths and bypaths. The paths contain only the apparatus necessary for maintaining the speaking connection, including the signalling and transmission elements at one stage. The bypaths, which are used for a few seconds per call and of which



This large annealing furnace, made by Birmingham Electric Furnaces, Ltd., for the English Steel Corporation, Ltd., was described in our last issue (p. 42). It is over 33ft. long and has a rating of 300 kW

there are relatively few, contain the apparatus necessary for establishing the connection and include the impulsing, selecting, and testing functions. This arrangement avoids the feature of individual control systems whereby the apparatus which is only employed to set up the connection is uselessly occupied throughout the conversation period.

A step-by-step uniselector constructed with fifty-one sets of contacts is used in all circuits; this selector can provide fifty-one sets of ten contacts or 102 sets of five contacts, according to the arrangement of the wipers. Although simpler in manufacture, operation, and maintenance than a two-motion selector, the uniselector is not so convenient for numerical selection. The auxiliary apparatus which is necessary to control numerical selection is located in the bypaths. As regards the finding function, a uniselector is more convenient and requires less apparatus for its control than a two-motion selector. Approximately nine paths can be economically served by each bypath. Each path consists essentially of one uniselector and one relay, both without timing or marginal conditions. A typical bypath contains two selectors and about fifteen relays.

The greater the number of functions that can be transferred from the paths to the bypaths, the greater will be the economy, unless such transfer involves any serious increase in the holding time of the bypath, thereby reacting on the quantity of bypaths required.

Considerable economy of floor space results from the use of the new equipment. The switch rack and bay construction permit 90 per cent. of the erection and cabling to be completed during bay manufacture. The wiring to the bays can be arranged during the shipping period. Complete routine testing having already been carried out in the factory, the whole process of installation is accelerated.

Saving in Space and Expense

The advantages introduced by the bypath system are not the result of any single idea. The more important economies are due to:—(*a*) The possibility of varying the size and number of groups of outlets. (*b*) The use of alternative trunking. (*c*) The fact that reduction in the number of transmission bridges saves apparatus and current consumption. (*d*) The reduced cost of routining equipment. (*e*) The fact that facilities for line discrimination as required for p.b.x. and other services are in a common circuit. (*f*) The possibility of selecting a suitable conversational path after the receipt of a discriminating digit or signal. (*g*) A simple method of preselection. (*h*) Reduction in the quantity of apparatus, such as impulsing relays and spark-quenching arrangements. (*j*) The fact that registering and translating equipment is used only on a small percentage of the traffic. (*k*) The elimination of coders. (*l*) Reduction in weight and space, which is also reflected in a saving in the cost of the building.

Television Discussed Informally

THE informal discussion at the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 9th attracted a large attendance. Mr. H. J. Barton Chapple, who introduced the subject, said that unfair criticism based on misunderstanding and false assumption had held back progress in television, but its development had been steady and sure, and full appreciation would soon be attained. In the early days pessimistic judgment was formed upon the flickering images of a "head and shoulders" with unnatural "beards" and shadowy patches, but now extended images were quite successfully transmitted, and "lookers" had full-length illustrations of types of dancing, games, dramatic sketches, &c., which had a definite entertainment value. The box receiver with a peephole had developed into a fair-sized screen that could be viewed from a distance and at an angle permitting a large number of people to view it at once.

The co-operation of the British Broadcasting Corporation had produced very considerable improvement in the past four or five months, and Mr. Chapple expressed the view that by the end of this year apparatus making use of a modulated projection lamp that would show astonishing improvement and facilities for group viewing would be on the market. The greater availability of a.c. on the completion of the grid would make it possible to use synchronised motors for the transmitting and receiving mechanism, and this would make for steadiness.

The difficulty with the cathode-ray oscillograph, which was so strongly advocated by some, was that it required expert manipulation. If this difficulty could be overcome, it would provide a most satisfactory medium for television. After considerable investigation the results had not been so consistent as those obtained by mechanical means. Mr. Chapple regarded the main application of the modulated arc as suitable for a large screen, but not for domestic apparatus.

Mr. H. Rissik, the author of the paper on "Recent Developments in the Application of the Mercury Arc Rectifier," read before the Sheffield Sub-Centre of the I.E.E. on Wednesday, and Mr. F. C. Knowles, who read a paper on "Electrical Measuring Instruments" before the A.S.E.E. on Tuesday last

Free Water from an Electricity Scheme?

A PAPER read on January 9th by the Dublin City Engineer, putting forward several interesting suggestions for enlarging the filtered water supply to the great area now known as Dublin, far transcending the previous bounds of the city, may have as its immediate outcome the formulation of a plan which should improve the civic outlook of the whole Irish nation, says our Irish correspondent.

Mr. M. A. Moyniham recommends, before any of his other plans, that in which he adopts Sir John Griffith's scheme for impounding the water of the River Liffey over the Poulaphouca Valley. If that were purely a water supply reservoir, 31,250 million gallons would be made available at the extremely low capitable expenditure of £10 per million gallons, for the cost of constructing the dam, diverting roads, acquiring and fencing

lands was estimated in 1925 to be about £300,000. This low figure is due to the favourable configuration of the terrain, which enables the dam closing the valley to be only 200 to 250 ft. along the crest to flood 4,900 acres.

Mr. Moynihan desires to take no more than twenty million gallons a day to augment his present supply from two other catchments, the Vartry and the Dodder, and suggests that the remainder—by far the larger quantity—should be used for the production of electricity in connection with the national supply. Sir John Griffith's scheme was based, it is believed, on the utilisation of the total need between the Poulaphouca reservoir and Lucan, on the outskirts of Dublin, at five or six power sites; whereas the Dublin Corporation, advised by Mr. Kettle and Herr Buchi, favoured fewer bites at the cherry, and, in fact, proposed to obtain about 18,500 h.p. out of a total of 29,000 h.p., from a head of 100 ft. (approx.), at the Poulaphouca dam. The capacity of the Liffey Falls, therefore, would be about equal to the capacity of the Pigeon House steam power station in Dublin.

Probably Mr. Moynihan could impound the Liffey catchment to a degree sufficient to satisfy the requirements of his own department at a reasonable capital cost without bringing a partner—and a predominant one at that—into his plans; and our correspondent gathers that his purpose in doing so is to get the work done by the Electricity Supply Board, without charge to the City of Dublin; and to obtain, in addition to that relief from capital expenditure, a perennial and eternal gift of his water requirements as "some slight restitution to the citizens of Dublin for the gross injustice done them when their electricity undertaking . . . was confiscated without one penny compensation in order to make it possible to supply electric current to citizens throughout the Saorstat, who in a great many cases did not and do not want it."

It is not necessary to discuss the "civics" of that sentence, or how the quarrel—if quarrel it be—is to be adjusted between the citizens of Dublin and the citizens of the Free State. All that matters to the electrical profession is that another water power site shall be developed; and that it shall be linked in the mind of the public with water-supply; for water-supplying is admittedly a public utility, chargeable on the area served, and made available by the civic authority for every person in the community, with the minimum of fuss and regulations, and at a "tariff" which has no complications, alternatives, entanglements, and botherations.

Above everything else we need to work upon the popular imagination until an irresistible demand arises for putting electricity supply into the category of public utilities. It is a long way from it now.

Advice on Rural Electrification

IN the paper which he read before the BELFAST ASSOCIATION OF ENGINEERS on January 18th Mr. R. M. Charley approached this subject not with direct experience of the operation of schemes of rural electrification, but as a manufacturer with knowledge of requests from operating engineers for the plant best suited to their individual requirements.

It is commonly thought that rural electrification can only be made to pay if the cost is kept to the lowest possible value. The author holds that if this is carried to the extent of installing the cheapest available equipment, a very mistaken policy is being adopted. Admittedly, the scheme must be worked out economically, but there are other factors than initial cost to be taken into account. He mentions briefly switchgear, then, more in detail, the type of transformer, both as regards mechanical arrangement and electrical performance, and, finally, voltage regulation equipment, for every operating engineer will, sooner or later, be faced with the problem of overcoming difficulties due to voltage drop.

Mr. P. Dunsheath, who is the author of the paper on "Ionisation in Cable Dielectrics," read before the East Midland Sub-Centre of the I.E.E. on January 17th

Switch- and Fusegear

For rural overhead lines the switchgear most suited to meet the requirements is a combination of a plain air-break switch with a cartridge fuse. Such fuses are now available with a guaranteed rupturing capacity of 100,000 kVA. Fuses having the same rupturing capacity can be made to operate under short-circuit conditions in 0.001 second or as long as 0.027 second, thus giving the very desirable feature of discrimination. The fuse also has definite time-current characteristics. The cartridge fuse is superior to any form of open wire fuse in that its maintenance cost is negligible. The solid filling is also superior to liquid filling owing to evaporation of the liquid.

The most suitable arrangement of the air break switch is the falling-frame type.

Most transformers are pole-mounted, and many are installed at remote points difficult of access. The greatest measure of reliability is needed to reduce maintenance costs to the minimum.

The transformer should be a complete self-contained unit, and the possibility of partial dismantling other than replacement of bushings, while in position on site, probably up a pole, should not be contemplated. The tank must be completely filled with oil and an expansion vessel must be provided. Off-load tapping switches should be provided in practically all cases; the extra cost is trifling compared with the great convenience secured, and the resulting more frequent and economical use of the tappings. It will pay the operating engineer to install probably the most efficient transformer the designer can put forward. The initial cost of the transformer expressed as an annual charge to cover interest and depreciation with the annual cost of the losses added is the best method for determining which of two or more alternative designs is the most economical. This method has been adopted by the Overhead Lines Association.

Balancing

For three-phase four-wire distribution several small (rather than one large) interconnected-star balancers are recommended. The fourth wire should be continuous and it should be given a high impedance to the flow of out-of-balance current by incorporating a choke coil in the balancer. An ordinary single-phase transformer with its primary winding connected across a pair of lines is better than a special unit for transforming from three- to single-phase.

Induction voltage regulation at the point of bulk supply will not always give the necessary good service, and it is most probable that small regulators may have to be installed on every distributor. The induction regulator provides the ideal means of meeting this problem, and there are many cases existing to-day where its cost would be recovered in a few years. Increasing the current-carrying capacity of the line is in many cases of little value and thoroughly uneconomical. Small induction regulators are usually automatically controlled and are sometimes provided with line drop compensation. They can easily be arranged for outdoor service and even for pole-mounting.

A combination of interconnected-star balancer and induction regulator is often very desirable, and is cheaper and less complicated than an on-load tap-changing balancer. Voltage regulation troubles will diminish as load factor is improved. Long vision is required and 33-kV distribution may prove to be a sound proposition.

Radiation in Boiler Furnaces

IN the paper which Mr. W. T. Bottomley read before the NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS at Newcastle-on-Tyne on January 13th, the effect is considered of the size of water-tube boiler furnace chamber and the amount of its water-cooled surface on the temperature which will actually be obtained, so as to enable the chamber to be designed to produce the desired results, and to limit the cost of the upkeep of the furnace.

The correct estimation of the temperature is not so important for determining the amount of water-tube surface required for the rest of the boiler to reduce the flue gases to the required chimney temperature by convection, but it is of considerable importance in determining the size and position of the superheater in the boiler, especially when generating steam at the high temperatures used in modern power stations. Very little appears to have been written in this country on the subject of radiation in boiler furnaces. The author develops a method of calculating furnace temperatures based on the absorption and reflective properties of apertures, or windows, in the walls of the furnace chamber. A curve has been plotted from experimental evidence which gives the emissivity of flames, and a method is outlined of calculating the effect of refractories.

A Coefficient of Emission or Absorption

The object is to show that the temperature of the gases leaving the furnace depends on the coefficient of emission or absorption, due to the furnace, at the surface of the water-cooled portion of the walls, and that this coefficient depends only on the amount of refractory walls, and on the amount

of radiating material in the flames. The coefficient is independent of the temperatures in the furnace, except so far as the temperatures affect the distribution and quantity of radiating material in the flames, and might, therefore, be determined under cold temperature conditions, provided the material in the flames could be represented correctly.

Fuel Constants

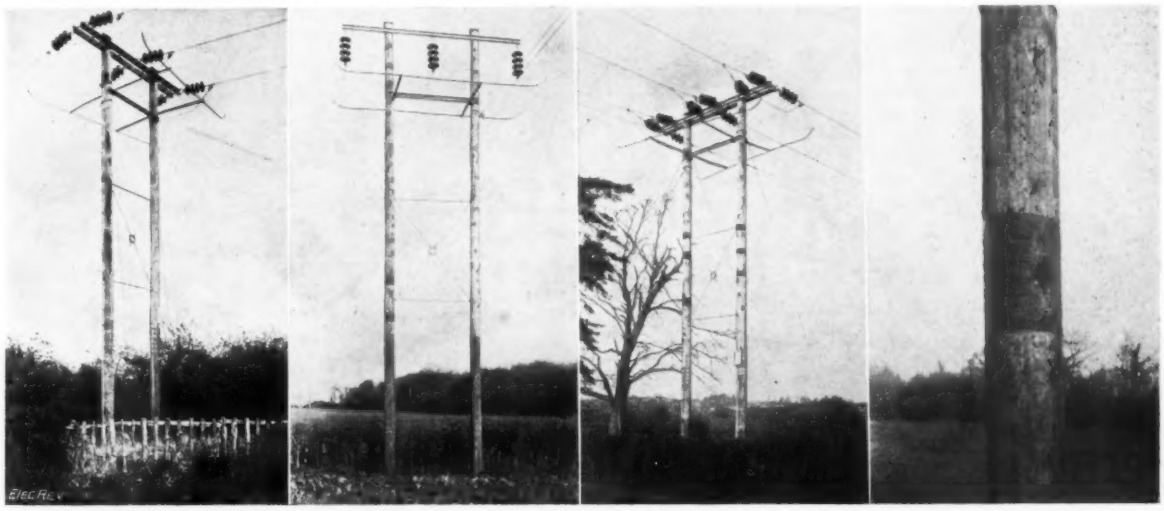
The effects of pulverised fuel flames have been determined on the assumption that the radiating material is uniformly distributed over the whole volume of the flame. The assumption, which is not unreasonable in view of the turbulence of the flames, gives results which are in accordance with American experiments on a large powdered-coal boiler. The results show that the flames are very opaque, and reasons are given for assuming that the radiation from the flames is mainly due to the particles of fuel and ash in the flames. The flame of an ordinary bituminous powdered coal can be represented for practical purposes as a black body at the centre of the furnace, the surface area of which is between 5 and 8 sq. ft. per million heat units liberated in the furnace per hour. Suggestions are made for values of constants for other fuels.

The Effect of Water-cooled Walls

The correction for the effect of refractories to be applied to the effective black body surface of the flames is stated; the furnace temperature is obtained, while the net heat transferred to the water-cooled walls is indicated. The method is applicable to all sizes of boilers, and might even be extended to include special calorimeters for determining the emissivity constants of the flames of different types of fuel. There is a tendency in all existing methods of calculating the furnace temperature to give undue bias to the effect of the water-cooled walls. It is not generally realised that the radiation transmitted to the water-cooled walls is limited initially and ultimately by the effective surface of the sources of radiation, which are the flames and the fuel bed. It is the main purpose of this paper to draw attention to this aspect of the question. The author is indebted to the Testing Department of the North-Eastern Electric Supply Co. for various pyrometrical observations made of boiler furnace temperatures.

Electric Arc Welding

AT a meeting of the London Technical Group of the ELECTRICAL POWER ENGINEERS' ASSOCIATION, on January 10th, Mr. E. P. S. Gardner, of the Quasi-Arc Co., Ltd., lectured on the increasing applications of electric arc welding to various forms of construction and repair and maintenance work. He said that an important part is played by the electrodes. The heavy-coated or flux-covered electrode consisting of a metal core with blue asbestos and a fine thread of aluminium running alongside the core produces slag which protects the metal from oxidation, cleans the surface of the plate, promotes good fusion, and obviates overheating. The operator might, through negligence, mix the slag with the metal, but this fault is discernible by the appearance of slag holes and can be rectified, so that the quality of the welding may be checked by visual inspection.



Some examples of damage by green woodpeckers to poles on the transmission system of the Shropshire, Worcestershire and Staffordshire Electric Power Co. (See our leading columns of November 25th, 1932). (From left to right): Damage to these poles on the Stourport-Tewkesbury line necessitated their replacement; poles lugged with bitumastic tape after plugging with bitumastic compound; a section pole near a decaying tree—the pole has been attacked, but not the tree; a second attack about 3 ft. above the bitumastic filling

The major portion of the lecture was devoted to descriptions of examples of the type of work now being done by electric arc welding, and they indicated the wide scope of this method. The idea that welded joints are unreliable when submitted to dynamic stresses is being refuted in practice by the gradual adoption of welding in lieu of riveting for the fabrication of railway rolling stock underframes of sufficient flexibility and strength to withstand the constant vibratory and shock stresses to which they are submitted. Since 1925 eighteen large electric locomotives have been supplied to the Swiss Federal Railways and many others have been exported. They weigh 147 tons, and the centre-frame, which is all welded, carries thirty tons of switchgear, transformers, &c.

In Hydro-Electric Work

One of the most far-reaching developments is the substitution of built-up welded frames for castings, and many all-welded pipe-lines have been constructed in various parts of the world, notably in Switzerland, Japan, Australia, and America. The Lochaber hydro-electric scheme of the British Aluminium Co. has provided the largest all-welded pipe-line in this country. The twin pipes in this case are 3,208 ft. long and about 6 ft. in diameter. They are ¼-in. thick at the head, and 1¼ in. thick at the bottom. The longitudinal seams are butt-welded, and the circumferential joints are socketed and fillet-welded inside and out. The test pressure was 500 lb. per sq. in., and the working pressure is 350 lb. per sq. in.

The lecture concluded with a detailed consideration of the application of electric welding to steel frame buildings. There has been a decided tendency for many of the advantages of electric welding to be lost through the designer adhering to existing forms of construction; if the fullest advantage is to be taken of welding, the structure must be designed entirely from first principles for welding. Many other examples of electric welding were referred to, and in his concluding remarks the author stressed very strongly the need for intelligent design, sound welding shop organisation, well-trained operators, and first-class welding equipment and electrodes.

The Paper Discussed

Mr. L. Morton stated that experience on the Continent had demonstrated in a practical manner that welding could be adopted for boiler work with the utmost safety. One could not fail to be impressed when visiting the Metropolitan-Vickers Co.'s works with the large amount of plant that was fabricated and built up by welding. Mr. W. J. Oswald remarked that in boiler repairs, for which "electro-deposition" was the only method to adopt, he had noticed that the weld was always hammered after it had been made. Did this make the metal more ductile and the job more safe?

Mr. J. P. Morley suggested that welding tended to increase the construction time. In welding a steel frame building was it necessary to have a welding plant for each operator, and would there not be difficulties in getting the plant to the top of a high building? Mr. A. E. Drew inquired as to the relative merits of electric and oxy-acetylene welding. Mr. A. W. Nunn said he was under the impression that boiler drum welding was not permitted in this country by the Board of Trade, and that the insurance companies would not cover work done in this way. He knew of one insurance company which would welcome a change of attitude.

Mr. W. V. Cooper referred to the atomic-hydrogen welding process. Mr. L. Morton said he did not think that welded boiler drums were accepted by insurance companies in this country. Mr. C. S. A. Munro mentioned that he had dealings with an insurance company which accepted welded repairs.

Mr. G. M. Sichel, chairman, referred to troubles with welded transformer tanks and the danger of girder distortion.

The Author's Reply

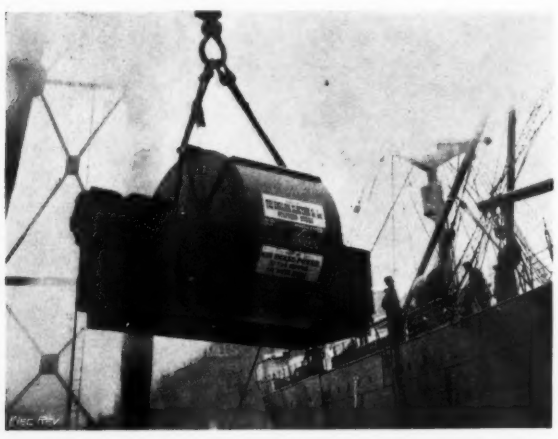
The author, replying to the discussion, said that whilst more welding work was being done abroad than in this country, this fact gave a false impression as to the part played by British engineers, because in many cases electric welding had been introduced into other countries by British engineers. Indeed, they had been forced to go abroad to develop their ideas. Welded boilers were not permitted by the Board of Trade because until definite regulations had been prepared as to how such welding should be carried out they would be simply asking for trouble. Two committees were now endeavouring to draw up a specification for controlling welded construction. The British Engine, Boiler and Electrical Insurance Co. had spent a good deal of time and money in research on this matter, and before long the present attitude would be considerably changed.

The machining properties of welded metal were the same as those of the parent metal. Hammering was frequently resorted to in America, but there were disadvantages in it; it was really necessary because the weld metal was not of the quality it should be, owing to the use of bare wire electrodes. For certain classes of work, welding was definitely quicker than riveting, and in shipyards it was acknowledged that a welder displaced a riveting squad. Multi-welder plants were available which enabled a number of welders to work from the same welding apparatus, and it was only necessary to run a positive cable to the top of a building, the structure itself acting as the negative.

For thin plate work he believed that the atomic hydrogen process was very successful. The thinnest plate that could be welded was about 1/16th in., but it was possible to go further than that with a highly skilled operator. Distortion prevention was a matter of practical experience. Loss of weld metal by evaporation was about 13 per cent., or from 18 to 20 per cent., including the end of the rod thrown away. X-ray inspection must be totally foolproof, otherwise it would be dangerous, because there would be a possibility of prior inspection being somewhat lax owing to the feeling that final X-ray inspection was to come.

Orange-growing at Power Stations

AT a meeting of the Birmingham and Midland Section of the SOCIETY OF CHEMICAL INDUSTRY held on January 12th, at the Birmingham University, Dr. Alexander Fleck read a paper on "A Possible Trend of Scientific Industrial Development."



A 60-ton load from the English Electric Co's works being shipped at Birkenhead for the large Pretoria steelworks now in course of erection

Dr. Fleck is a director of I.C.I. (General Chemicals), Ltd., and executive director of the Synthetic Ammonia and Nitrates and Cassel Cyanide Co. He holds the view that the application of science to industry has resulted in overproduction, and by way of remedy contends that research carried out on the right lines should be applied to the problem, bringing it more readily within manageable proportions.

He put forward the suggestion that by the scientific utilisation of the waste heat resources of this country we could grow oranges and cotton and other tropical products adjacent to our big electric power stations. We had, he said, quantities of low-grade heat from the condensers of our turbines, or, if that was not adequate, steam was available from very efficient combustion of fuel. We had any amount of energy for the necessary light conditions. We had plenty of water. We had cheap fertilisers, and plenty of carbon-dioxide for the plants to assimilate. Therefore, there ought to be round high-efficiency power stations large farms for tropical fruits and produce, and in these we had the possibility of replacing large quantities of our imports of tropical products.

Improving Rural Life

Was it beyond the range of science to work trees and plants on a twenty-four hour basis by giving them continuous supplies of adequate heat and suitable light? If that were made possible with the cotton plant, it would open a possibility of making the textile businesses of Lancashire independent of the troubles of American exchanges. The people of this country would not return to agricultural life as it was led by agricultural labourers to-day. But if conditions of agricultural work were reduced to those ruling inside technically efficient workshops and factories, we would immediately have a population well qualified to develop such schemes.

If the rate of growth could be increased, as they knew it could, could they not multiply it so that it would be possible to grow wheat in controlled conditions inside specially adapted buildings fitted with lighting, heating, water, and fertiliser supplies, so that the yields would be regular and of a predetermined quality? There was also scope for the application of engineering science to farm construction.

The Co-operation of Physicist and the Engineer

PROFESSOR C. G. DARWIN lectured on the subject of "Physics and the Engineer," at a recent meeting of the ROYAL SCOTTISH SOCIETY OF ARTS at Edinburgh. He said that the relationship of the physicist of the University with the engineer was to their mutual benefit, for if the theorist provided the starting point of a scientific subject for the engineer to work out, the engineer, when he had done so, handed back to the theorist instruments whereby further advances of knowledge were made, which would otherwise have been quite out of reach. Examples of the kind included the making of exceptionally strong magnetic fields, the measurement of electric currents, and the discovery and uses of the inert gases of the atmosphere.

One of the most remarkable cases of all was the hot-wire principle. A wire raised to red or white heat gave off electrons, which, on account of their extraordinary lightness, could be blown hither and thither by electric fields, the result being that quite weak fields could produce large electric currents. Effectively, what happened was that the electrical instrument was almost incredibly lightened; instead of having to move a pointer, which, with the best conceivable designing, was bound to weigh, say, at least a milligramme, they now only had to move an electron of infinitesimal weight, and the hot-wire principle provided an extremely powerful relay by which the motion of the electron could be comparatively easily made.

The principle had invaded the field of power engineering, for, in the most modern practice, alternating current was no longer transformed to direct by the rotary transformer, but instead by making use of the rectifying effect of the current from a gigantic hot wire. The experimenter in the University had benefited by all these developments, and much of the most recent work on atoms would hardly have been possible without them.

* * *

Electricity in Varnish Making

At a meeting of the Nottingham Section of the SOCIETY OF CHEMICAL INDUSTRY on January 19th at Derby, Mr. J. Arthur Reavell read a paper on "Modern Chemical Plant," in which he dealt with the direct application of electricity in chemical processes, particularly for the treatment of varnish and oils in varnish making; the direct application of electric heating elements to raise oils and varnishes to high temperatures whilst maintaining relatively low temperature differences between the electrical elements and the oils or varnishes; the subsequent maintenance of the oil at given temperatures by thermostatic control; and the application of electricity in the chemical industry in connection with fluid heat transmission. The latest method of preparing certain suspensions, by which a magma is produced with a constant solid content, whereby drying can take place to produce a powder of constant moisture content, received attention. This method eliminates all filter presses, rotary filters and drying after filtering, and obviates any grinding.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Contactor Starters

No doubt many of your readers share the views of "Dilemma" regarding the controversial subject of the use of small contactor starters. As one who, until recently, has been actively engaged in the design of these from the time when thermal overload releases were first put on the market, I could put forward a large number of selling points to indicate the superiority of contactor starters over their hand-operated brethren.

These, in brief, are: simplicity of design; the speed of make and break of contacts, which is independent of the operator; self-cleaning contacts, due to correct roll and wipe action; and ease of incorporating no-volt and overload features without the use of complicated mechanical trigger mechanisms. But I contend that an equally good case can be made out for the modern hand-operated type of starter, especially if it be oil immersed. Generally speaking, the hand-operated starter is more robust mechanically as its parts must necessarily withstand the efforts of heavy-handed operators when it is in service.

For ordinary industrial conditions equally good service is given by a contactor starter and a hand-operated article of similar quality, but the greater robustness of the latter shows marked advantages over rather flimsy small contactor starters where the conditions are at all arduous. Small contactor starters, complete with operating push buttons in one case, have become "fashionable," but it is safe to say that in at least 50 per cent. of the instances where they are used, the hand-operated type gear would be equally suitable and probably better able to meet the conditions.

The crux of the whole problem is the capability of the small starter or circuit-breaker to contend successfully with possible overloads and short-circuits to be encountered on the system controlled. The average thermal overload release, although theoretically ingenious, is far too flimsy adequately to deal with the heavy short-circuits which can occur on modern supply systems, and is too prone to "go up in smoke" under such conditions. It also permits of continuous overloads up to 25 per cent., which may or may not be harmful. It is unsuitable for use in positions where the ambient temperature is high, *e.g.*, in the vicinity of boiler plant and heating apparatus.

There are a few good thermal overload releases, but there are many of a very poor design, and it behoves the buyer of small starters and switchgear to be very circumspect in their use if he desires long and trouble-free service and reliability of operation in an emergency. EQUALISER.

January 10th.

Automatic air-break contactor starters generally have the advantage of being smaller than the oil-break type, and can therefore be mounted on a machine tool close to the operator's hand. From the operating point of view this is an advantage. Further, to press a button is always simpler and quicker than to operate a handle.

As regards the oil-immersed hand starter being more robust, this surely depends on the design. It is being recognised that a well-designed air-break switch on frequent interruptions of normal current requires less attention than oil-immersed switchgear, the great advantage of which is its high rupturing capacity and definitely not its ability to rupture a current with extreme frequency (as in a motor starter) without attention to the oil and contacts. Air-break starters do not need this attention, and are far easier to clean when they do want overhauling. Oil switches operating in deteriorated oil are not as satisfactory as air break switches.

Undoubtedly bi-metallic thermal overload relays may take up a permanent set and are liable to be damaged in transit.

The electric drive in a large Lancashire cotton-spinning mill

The "solder-pot" type overload relay, however, is freer from these troubles, and both types, if well designed, compare favourably with magnetic overload relays for accuracy in operation, especially after a period when the oil in the dash pot may be in need of renewal. Thermal overload relays do not require maintenance under normal conditions. They are free from the troubles of floating cores and the alteration of time lag due to changes in the viscosity of the oil with temperature. Further, the watts taken by the solder-pot type are lower than those taken by the magnetic type, and the saving may be capitalised at a considerable percentage of the original cost of the starter over a few years.

In conclusion I may say that the main advantages of the air-break contactor type with thermal overload relays are its small size, its ease of operation, and the little maintenance required. W. J. DONOVAN.

Birmingham, *January 13th.*

Inadequate Mains: Indifferent Employés

In contrast to my rebellious outburst against the electrical industry I offer the following three suggestions for inclusion in Mr. Reynold's enlightenment campaign.

(1) That some wiring expert such as Mr. T. C. Gilbert (I fear that the "Sbik" system would be too brainy for English mains engineers) should be commissioned to prepare plans in conjunction with an architect, showing the minimum permissible electrical installation in private houses of ten different grades. Copies of these plans could be sent to all distribution engineers together with instructions not to pass any installation which did not conform to these requirements.

This would cut out the plumber cheap-jack who is slowly but very surely stealing the house-wiring business on price alone by installing inadequate systems and even supplying radiators equipped with long flexibles to serve all the bedrooms from the landing socket. Recently I discovered a relative bathing her baby by the warmth of a bowl fire which was balanced on the bath seat and supplied by a two-core flex from the landing socket.

(2) That steps should be taken to halve the profit on all electrical appliances. Last month I paid a dealer, who allows me *some* discount, 1s. 9d. for a lamp which he retails at 2s. 3d. I presume that he made at least 3d. on that deal. It is surely worth *our* while taking notice of the paper which Professor Miles Walker read before the B.A.

(3) That electricity committees be supplied with lists showing the minimum practical and technical training which the various grades of employés should possess, and suggesting that appointments and promotions should be made accordingly. The I.E.E. examination, which is not very difficult, might be taken as the technical standard for say switchboard attendants, mains shift men and all others earning £4 per week and over. This would bring a higher intelligence into the supply industry, and would strengthen the I.E.E. considerably. After all, it should be possible to carry out this campaign entirely through the I.E.E., but we must face the fact that such feeble brains are employed in some branches of the industry that this is impossible.

Unfortunately, some committees distrust the I.E.E. owing to having been served badly by some of its members who have gained membership on the age limit system. Cannot the I.E.E. provide these members with a distinguishing letter after their names? I should suggest a small " k " or a capital " L " to follow the usual letters!

With regard to heating: I am absolutely in favour of low-temperature devices such as wall tubes, but I shall never advise anyone to install a red-heat appliance of either radiation or convection type unless it gives air changes equal to those of a coal fire. A doctor friend tells me that he goes into houses to find sick people breathing burnt air from electric radiators in bedrooms—some without flues and others with the flues stopped up " to save money." I do not believe that an electric water heater will keep the water, airing cupboard and house as warm as will a coal system at anything like similar cost. As for electric cookers, I know too much about consumers' pressures to advise such things. Makers of these could do worse than to wire them up for 20 per cent. under the stated voltage and provide a rheostat in one main and a voltmeter across the cooker terminals, complete with instructions to keep the pointer on the red line.

I have no grievance against particular individuals, but my complaint about the supply industry is that promotion is either on the theatre queue system or on that by which a father can pay a premium which will enable his son to obtain preference over those who have years of experience and superior technical ability. I am fully aware and thankful that this industry is providing my bread and margarine (not butter) but as long as such conditions exist in it I can do no other than sign myself

January 10th. AN INDIFFERENT EMPLOYÉ.

I have read with some interest the correspondence at present appearing in your columns concerning the advancement of young engineers in the industry. As a suggestion to some of them to whom the knowledge of what has been done by others may prove stimulating, I append brief details of my own career.

The Marconi " C.A.T.14 " valve with and without its cooling jacket. (See page 100)

My family were without means and at fourteen I found myself an office boy in an Oxford Street jewellers. At nineteen I was a designer of electrical machinery, a.c. and d.c., of miscellaneous types and sizes. At twenty-three I was chief assistant engineer with a well-known firm of consultants; at twenty-five electrical engineer to switchgear manufacturers of repute; and at twenty-eight sales manager for a firm of mechanical engineers. At thirty my salary for the previous five years had averaged over £500 per annum. At forty—but I have still several years to go—*Quien sabe?*

B.Sc. (LOND.), A.M.I.E.E., A.M.I.MECH.E.

January 9th.

If Mr. F. P. Wills had taken a little more of the ample spare time which he has available for criticism to read my article properly before offering me his advice, he would have seen that my remarks with regard to inadequate mains referred not to one particular locality, but to old low-pressure networks in existence throughout the country.

Gloucester, *January 10th.* R. D. REYNOLDS.

Lead-covered Cables at Sea

As one who, like Mr. M. S. Bagnall, has had experience of lead-covered cables in ships, I can endorse his statements regarding the unsuitability of this system. I have repeatedly noticed that although all circuits are in good working order before the ship leaves her berth, trouble with wiring " blow-outs " may start as soon as she puts to sea. A period in dry dock or a spell of bad weather has the same effect in a minor degree, which I think proves conclusively that the " working " of the ship's structure may cause cable failure.

I think that the tough-rubber-sheathed type of cable would give more reliable and safer service. An efficient connection to the ship's steel structure can always be obtained for " earthing " fittings, so the absence of the lead sheath would be no great loss in that respect. Can any correspondent show us why rubber-sheathed cable should not be used for wiring passenger accommodation? HARRY W. BEARA.

London, W.5, *January 14th.*

Living Conditions in India

Your correspondent " Enquirer " asks for general information *re* the cost of living, &c., in India. It must be remembered that India is a sub-continent, and there are such great variations in both climate and living conditions that it is not possible to generalise. Again, conditions as between different firms vary greatly, *i.e.*, home passages and leave allowances, free medical attendance or otherwise, conveyance to and from the office, &c.; home leave is necessary every third year.

The cost of living is highest in Calcutta and Bombay, where a young man would require a minimum of Rs.500 per month, or, if married, Rs.900. If the new man is going out as representative of his firm or to a senior position, then membership of two or three clubs and a car are necessities and a minimum salary of Rs.1350 will be essential. For Madras the figures would be slightly less, and for the Moufussil about three-fifths would suffice. I am not qualified to give an authoritative opinion about the other cities, but suggest that about three-quarters would be about right.

As indicated, each case requires more or less individual consideration, but if any reader cares to postulate a set of conditions I would be pleased to give any information or guidance I can. QUAI HAI.

January 14th.

The Indian climate varies in different provinces. The cities mentioned—Calcutta, Bombay, and Madras—are not too bad, although Madras is a little hotter than the other places. The hottest months of the year are April and May, but one gets delightful weather in October and until February. Taking everything into consideration I prefer the climate of India to the treacherous weather of this country.

To keep fit one should take plenty of exercise, and alcohol should be taken in strict moderation. The income mentioned is only a junior's income. The cost of living in any of the cities, such as Calcutta, is far above that in England. Most mercantile firms do not provide bungalows, so one has to take rooms in the very expensive European quarter. No one should contemplate going to India on an income less than Rs. 600 per month, for to live comfortably in Calcutta the cost will be at least Rs. 500 per month. Indian salaries look very attractive in sterling, but one must not forget that the rupees are spent in India. The outlook was totally different a few years ago when the rupee fluctuated. I think well on in the thirties is quite a decent age to change over to an eastern climate, and one is more settled and not liable to " go off the deep end." Some who go out at an early age lose their heads, and lift their elbows too often, and consequently are pushed off home after a short period. BIJLEYWALLAH.

January 15th.

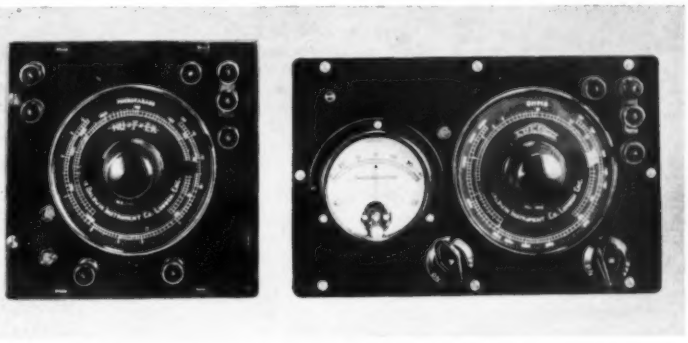
New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Baldwin Test Sets

Two useful testing instruments made by the BALDWIN INSTRUMENT CO., 24, Well Hall Road, Eltham, are exceptionally accurate for their prices. Both are direct reading with an accuracy within 2 per cent. The "Mu+F+ER" capacity measuring bridge incorporates an oscillator, which produces a.c. of audible frequency, in the form of a neon tube energised (0.1 mA at 120 V) by an external battery. It is thus mechanically silent and does not need adjustment like a buzzer. A high-resistance telephone receiver is used as the detector and a special potentiometer makes the two scales, obtainable by the inclusion of two standard condensers in the circuit, uniformly logarithmic over the whole range from 0.00005 to 4μF. The instrument weighs 1.5 lb., measures 6 by 6 by 3$\frac{5}{8}$ in., and costs 75s.

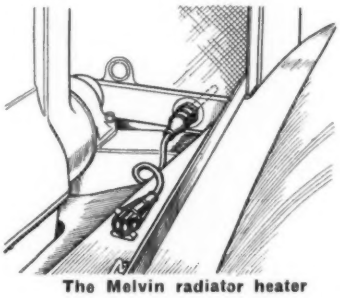
The "Logohm" d.c. resistance measuring bridge is made in two models, "Mark I" needing an external galvanometer and battery, both of which are, however, included in the "Mark II" (illus.). The special potentiometer makes the two scales uniformly logarithmic throughout the two ranges of 0.5—160—40,000 ohms, obtainable with two balancing resistances. A battery key is provided and also a key operating a low-resistance shunt to limit the galvanometer throw. "Mark I" weighs 1.5 lb., measures 6 by 6 by 3$\frac{5}{8}$ in., and costs 70s. "Mark II" weighs 2.25 lb., measures 8$\frac{3}{4}$ by 5$\frac{1}{2}$ by 3$\frac{5}{8}$ in., and is priced at 110s.



Left: The Baldwin capacity bridge. Right: A "Logohm" resistance bridge ("Mark II")

An Unusual Radiator Heater

MESSRS. MELVIN, LTD., 17, Leighton Place, Kentish Town, N.W.5, have lately put on the market a simple device for keeping the engine cooling water of cars warm during the night and so preventing freezing in extremely cold weather. The device consists of a heating element enclosed in a sealed metal tube equipped at its outer end with a thread, which enables it to be substituted for the normal radiator drain plug. Once fitted, it does not have to be touched, for to bring the heater into service all that has to be done is to couple it up to a plug point in the garage.



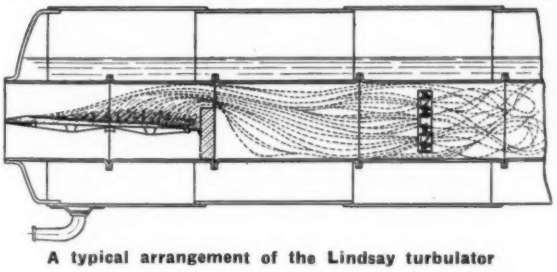
The Melvin radiator heater

The power consumption is stated to be very low, the heat being sufficient to keep the water at a comfortable warmth, with no possibility of boiling. The device is offered not merely as a protection against freezing, but as an aid to immediate starting in the mornings after cold nights. The standard thread is $\frac{1}{4}$-in. gas, which suits many of the most popular makes of cars, but for a few pence an adaptor can be obtained for any radiator, while if there is no drain plug handily placed a plate with a standard thread for soldering on is procurable. The price of the heating element is 20s. Our illustration is reproduced by courtesy of *The Autocar*.

A Fuel-saving Turbulator

The "Lindsay" turbulator has recently been introduced by the UNDERFEED STOKER CO., LTD., Aldwych House, Aldwych, W.C.2, for promoting complete combustion of gases from Lancashire-type boiler furnaces. It consists of a disc made up of cast-iron segments to which are fitted four venturi cones. Around the periphery of the turbulator are angular vaned castings, and the whole is faced with high-grade refractory.

The apparatus is fitted from 6 to 8 ft. behind the bridge wall of the furnace, and the products of combustion, together with the excess air present, must pass either through the cones or the vaned space around the turbulator. The vanes impart a very high degree of turbulence to the gases, and the cones are set so as to direct the gases towards the wall of the flue, thereby still further increasing the turbulence. The combustible portions of the gases are thoroughly mixed with the air, resulting in much improved combustion, a higher temperature, more intimate contact of the gases with the flue walls, and therefore a higher rate of heat transference. The equipment becomes almost incandescent, and the combustible gases impinge on the hot surfaces exposed. Apart from the advantages of greater heat release and transfer there is a marked reduction of smoke emission, and a 5 per cent. fuel economy is claimed for the equipment.



A typical arrangement of the Lindsay turbulator

A Cold Box Compound

MESSRS. BLACKALL BROS. & BERRYS, LTD., Stratford Market, London, have introduced an insulating compound called "Pensulate" which is claimed to have a breakdown value of 20,000 V (gap 3/16 in.). It can be used cold for filling joint boxes and is supplied in colours for phase-marking purposes.

An Automatic Clutch

An entirely automatic clutch has recently been introduced by the BRITISH "REMA" MANUFACTURING CO., LTD., Halifax, for use in conjunction with electric motors driving heavy machinery. Even when direct coupled to a machine there is no load resistance until the motor is revolving at full speed. Also, when there is an overload the motor will continue to drive at its maximum permissible load with the clutch slipping; the length of time taken for picking up to full load can be adjusted to suit particular conditions.

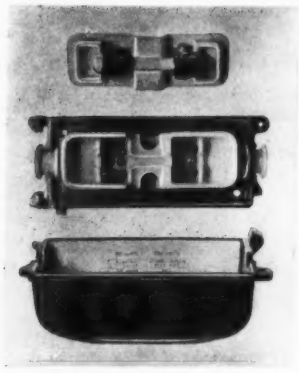
The illustration shows the simple construction of the clutch in its dismantled form. E, an impeller, is keyed fast to the driving shaft, and is carried in a serrated housing B, rotating in two journal bearings in the end covers C. When the clutch is assembled the shot D is introduced through the plugged hole A to the amount necessary for the desired starting conditions and maximum power. There is provision for lubricating the journal bearings without the possibility of grease reaching the annular chamber containing the shot.

The components of the "Pulvis" clutch

This new "Pulvis" clutch can be used, among other things, with wood-working and textile machinery, punches, shears, cold saws, railway turntables, air compressors, centrifugal separators and hydro-extractors, hydraulic pumps and fans.

B.I. Ironclad Service Cut-outs

The National Physical Laboratory has recently tested a new ironclad service cut-out which has been introduced by BRITISH INSULATED CABLES, LTD., Prescot, Lancs, and found entirely



A 60-A s.p. B.I. cut-out

satisfactory. The working current is 60 A, the fusing current 120 A, and the short-circuit current 4,000 A, and the design complies with the I.E.E. regulations and British Standard Specification 88/1931.

The fuse units of this new range of cut-outs are provided with expansion chambers at each end, and the communicating passage between them is shaped to fit closely the small-bore asbestos tube through which the fuse wire is passed, by which means a barrier is provided between the terminals. The contacts are isolated from the expansion chambers, and therefore cannot be damaged by arcing or the deposition of fused metal. The base contacts are fixed so that they are self-aligning, and the one-piece fuse carrier spring contacts are of the self-adjusting and pressure type, consequently the fuse carrier cannot become loose through vibration. The asbestos tube is of robust construction, and cannot be accidentally detached from the fuse carrier, and all parts are interchangeable and substantial.

The complete range of cut-outs includes, 15, 30 and 60-A sizes single and multi-pole models for 250-V circuits. The price of the 60-A d.p. model is 6s. 3d. (in one dozen lots).

Synchronous Clock Switches

In the Synclock time switch the spring-driven clock is replaced by a small a.c. self-starting synchronous motor. The rotor and gearing of the motor run in an oil bath contained in a metal housing, which excludes dust and damp, and the spindle runs at 1 r.p.m., suitable reduction gearing being employed to operate the time dial. The time dial revolves once in twenty-four hours and is provided with a scale round its circumference. This scale, which is 9 in. long, is divided into quarter-hour divisions, thus permitting very fine settings to be made. The daylight period is distinguished by a white surface with black figures and the night period by a black surface with white figures.

The Synclock "B.O." time switch in an iron case

The tripping riders are readily accessible for easy and accurate setting, two such riders, to give one "on" and one "off" setting in the twenty-four hours, being normally provided. Additional riders can be added to the dial according to requirements. Where a shorter interval than one hour between the "on" and "off" switching is desired, special riders can be supplied. The full advantages of this time switch for street and shop window lighting are only secured when it is provided with solar dials, when operation times are automatically advanced or retarded according to variations in the time of rising and setting of the sun.

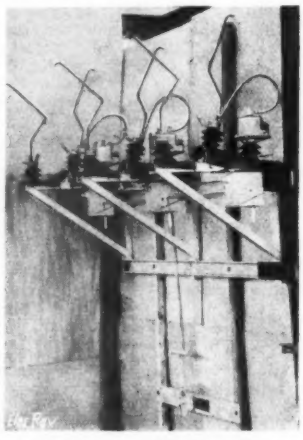
The riders are attached to movable radial arms which bear against specially shaped cams. These cams are turned through a very small angle each day by the normal rotation of the dial and thus adjust the position of the riders, allowance being made in the cams for the difference which exists between the local time (*e.g.*, Greenwich) and solar time. When it is desired that the switch should not operate on any given day (Sunday, for example), a cut-out attachment can be provided to give a single pair of operations (on and off) each day. If a cut-out is desired on time switches performing more than a single pair of operations each day, special arrangements are available.

The switch contacts are operated by plungers depressed by the riders carried by the time dial, each plunger being slowly depressed against a spring and when released rotating a cam which closes or opens the switch; a quick make and break action is thus secured. The "make" and "break" riders and plungers are distinct, so that it is impossible for the operations to get out of step, thus switching off when it should switch on.

The model A.P. Synclock time switch for street lighting is fitted with a press key to close the lamp circuit independently of the switch contacts. This useful device simplifies and speeds up periodical inspection and replacement of street lamps in the day time, since it is not necessary to disturb the setting of the switch to test a lamp. The B.O. and B.C. switches if desired can be similarly equipped. The motor is self-starting. The makers are SYNCLOCKS, LTD., 117, Victoria Street, Westminster, S.W.1.

Pole-mounting Circuit Breaker

A recent introduction of MESSRS. J. G. STATTER & Co., 16, Great George Street, S.W.1, is a pole-mounting circuit breaker for 11 and 33 kV. Although the breaking capacity of this switch has not yet been proved, its operation in the open air renders its capacity for clearing an arc greater than that of the enclosed type of breaker. The arc has a clear field, and gases do not therefore accumulate.



A Statter three-phase pole-mounting switch

It is constructed on an angle-iron frame which, with the operating handle below, is galvanised. Pull-off springs of specially treated galvanised steel are embodied, and all the hinged pins are grease packed. All the spindles are of monel metal, and the current-carrying parts are electro tinned. Shed-type porcelain insulators are used, being thoroughly vitrified and glazed to meet B.S.I. requirements. The insets are first coated with a thin layer of plastic compounds to allow for expansion and contraction. The trip rod insulator is of high-quality "Bakelite" tube, covered with "Pernax" insulation. "Pyrex" rods are used for 33 kV.

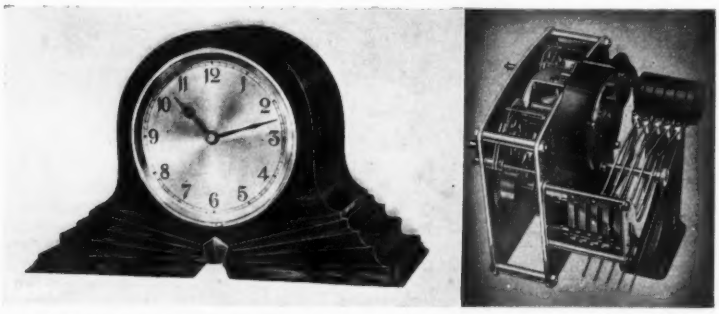
The overload trips are calibrated for from 40 to 200 per cent. normal current. A laminated brush is fitted to carry the current, so that the switch is not dependent upon the contact made by the arcing. Protection against bird interference is provided by "Pernax" or other guards where necessary. A constructional feature is the housing of the overload coils in metal containers above the rear insulators.

Slotted Line Taps

We are informed that the ELECTRICAL EQUIPMENT AND CARBON CO., LTD., Bank Buildings, 107-111, New Oxford Street, W.C.1, has just brought out a range of new slotted line taps. They consist of only three pieces, and the centre fixing bar is slotted and cannot fall out during erection. The smallest size, with a maximum conductor size of 0.009 sq. in., costs £1 5s. per hundred, and the largest, 0.1 sq. in., costs £3 11s. 6d. per hundred.

Electric Chiming Clocks

We have been informed by MESSRS. BROWN BROS., LTD., Great Eastern Street, E.C.2, that a range of Garrard electric chiming clocks is now available. These clocks, which are made by GARRARD CLOCKS, LTD., 117, Golden Lane, E.C.1, are available at three prices. The "Electra," in oak, costs seven guineas; the "Faraday," in mahogany, is priced at eight guineas; and the walnut model, the "Impulse," costs two shillings more.



(Left) The "Impulse" electric chiming clock; (right) electric chime movement

The driving motor is made in the form of a self-contained unit, and can be readily detached from the movement by removing two screws and disconnecting the wires from the two studs at the bottom of the back plate. The standard movement is suitable for 200/250 V at 50 cycles, but movements arranged for 110 V, 60 cycles are also available. The electrical connections, starting lever, chime silencing lever, hand-setting knob, and winding spindles are all accessible through the back of the case, and the method of mounting is exactly the same as is used for the spring chime.

The Garrard movement is fitted with a chime and strike corrector which automatically corrects the chimes and strike, and there is also a lever to silence them if they are not required. The chime and striking movements are actually spring driven, the electric motor being used to keep the spring fully wound up.

Our Sales Responsibilities. By V. W. Dale

The Business Manager of E.D.A. stresses the duty of the industry to the public

PARALLEL with the completion of the grid the electrical consciousness of the entire nation is awakening, and the man in the street and the woman in the home are all possessed of an idea which registers variably from clear to hazy that electricity is closely related to health, comfort and happiness, and to some extent is also an important contributing factor to the rehabilitation of industry. Whether the inauguration of the grid reaches us as the materialisation of a happy dream, or as a nightmare, nothing can possibly be gained and a great deal might conceivably be lost by failure on our part to face up to the added responsibilities which the grid imposes upon many of us. So far as the public is concerned there is not the remotest sign of any lack of confidence in the provisions which have been made to provide and maintain an adequate supply, while there is any amount of evidence all around that our competitors are certainly under no illusions as to the great opportunities that are literally within our grasp.

A broad survey of the position can be summed up very briefly in :—

Seven Fundamental Considerations

(i) The electrical industry of Great Britain has something like a wholesome five million consumers to its credit. (ii) It also has an unwholesome average connected load of a little more than 300 W and an anæmic demand per head of population of the order of 230 kWh per annum.

(iii) There are to be found on the route of existing mains approximately another five million potential consumers, less easy to obtain because a great many of them are tenants occupying other people's property. (iv) But it is a " pound-to-a-penny " that during the current year at least another half a million new consumers *will be* connected. (v) It is contemplated also that during the year the electricity supply industry will " catch up " to the gas industry on the line of revenue derived from the sale of light, heat and power. (vi) Diminution in the market for by-products of gas manufacture will render any reduction in the price of gas extremely doubtful, whereas, to the best of our knowledge and hope, the average price of electricity has not yet touched bottom.

(vii) It is therefore to be expected that the intensive propaganda and sales work of our contemporaries, especially as regards domestic supplies and public lighting, will not be curtailed, and this cannot fail to create increased resistance to electrical development.

It is true that electrical statistics covering the last decade make a spectacular show on paper—in fact it is only fair to admit that British electricity supply undertakings have put up a very creditable performance in comparison with many other countries—but the economic salvation of the industry demands something more substantial than figures and panegyrics. In spite of the fact that in ten years connections and units *sold* have increased 500 per cent., the average connected load per consumer and the consumption of energy per head of population are still of such slender dimensions that electrical salesmen, and also those people upon whose shoulders lies the burden of responsibility towards the investing public, cannot rest content until they see an almost vertical rise in these two curves.

Not Too Easy

The task immediately before us is not quite so easy as shelling peas. The complexities which enter into the problem of selling electricity are very acute and almost unique in the realms of salesmanship, but they are not beyond the skill of the controllers of our supply undertakings : indeed, scores of areas immediately flash to one's mind where enterprise, scientific management and a determined policy, firmly established on a foundation of experience and sound technique derived from the best brains of the industry, is creating a large, rapid and profitable demand amongst all classes of consumer and for all classes of load. And there are others!

There has always been some divergence of opinion as to the policy of increasing the number of electrical showrooms. Many large towns divide into two or more " districts " and the residents in one district rarely invade the other. I recall such an area having at this time 30,000 connections and another 30,000 unconnected premises on the route of the mains. For many years the undertaking possessed one meagre showroom, the superficial area of which was equal to an artisan's Sunday parlour; it was situated on a very secondary main road half a mile from an important shopping centre. A year or two ago a magnificent suite of demonstration rooms was erected on the site but events have not been permitted to remain there

To-day, the undertaking possesses in addition two excellently equipped district showrooms for the very reason that the central showroom was inconveniently situated for a vast number of people living in the outer districts. Never at any time in the history of the undertaking, which is situated in a comparatively poor industrial area, has progress been so rapid as it is now both as regards connections and load building.

It is urged that all supply undertakings should give earnest consideration to the provision of more points of contact—permanent and temporary—where regular and frequent demonstrations of electric cooking, water heating, and of a score of appliances, essential to development, can be carried on, and where consumers and prospective consumers of all classes can obtain reliable electrical advice and information.

The *electrical invasion* is something more than a phrase : the protean service of electricity must not in any sense be confused with the narrow service of gas, and for this reason it is the bounden duty of everyone in the industry to do all that he can to place a knowledge of electricity and its many applications before all sections of the general public. More educational propaganda is required. In matters of advertising many undertakings appear to be prevented from making any greater effort than one associates with a small shopkeeper. Consumers and prospective consumers should be informatively appealed to regularly in the local newspapers, on the hoardings, on the cinema screens, by the circulation of literature and by direct-mail seasonal appeals. For the last purpose good sectional mailing lists of all consumers and of all prospects are vitally necessary : the lists should be produced on coloured index cards so as to enable any class of consumer to be " attacked " expeditiously as and when required.

Adequate Staffs are Imperative

Sales teams must be brought up to a strength commensurate with the *prospects* of the undertaking : the sales side of the supply industry in a vast number of undertakings is grossly understaffed. Opportunities must be made for carrying out demonstrations in the schools, before factory executives, shopkeepers, housewives, and in any place where thinking men and women congregate. Consumers must have facilities for obtaining appliances on easy hire and hire-purchase terms equal to the most successful schemes which have been tested and found satisfactory in similar areas. Large undertakings at all events should have at least one sales expert in each special section of the business, *e.g.*, water heating, cooking, space heating, and so forth.

At this very time thousands of prospective consumers are waiting to be connected. In many places assisted wiring schemes are being absolutely crippled by a futile effort to promote economy. Yet we have thousands of wiremen and mates unemployed while remunerative work waits. The jointer problem is admittedly rather more difficult : good jointers, as a rule, are born, not made, but a crisis postulates emergency measures and it should not be beyond the wit and wisdom of the supply undertakers and the trade unions to find ways and means for getting on with the volumes of work waiting to be done.

Notable electrical achievements, particularly with regard to the displacement of some other form of prime mover, or space heating in a large building, or a large thermal storage job, should be given the utmost publicity. The Press and many electrical societies provide a platform for this purpose, and a great deal of good can come from the pooling of knowledge and experience. In a comparatively young and progressive industry such as ours it is astonishing that there should be any need to appeal for greater commercial intercourse. Too frequently in recent times there have been symptoms of a tussle between individual and associational principles.

Misguided Individuality

This is not the time for erecting a Tower of Babel in the electrical industry, neither is there room in it for a score of Nimrods. Those well-intentioned people who persist in trifling personal prejudices in the design of an appliance after a representative body of experts have dealt very thoroughly with the matter, or who insist in producing their own doubtful poster at an inflated price after a first-rate artist of outstanding ability has been instructed to produce one for a central organisation, or who flatter themselves with the authorship of pernickety trimmings to an already overloaded list of tariffs, or who in any other way choose to be isolated from the experience and labours of their contemporaries—are assuredly contributing to those factors which tend to arrest rather than to promote development.

Our problems are not nearly so diverse as we often imagine, and in any case we have only *one* public to consider and serve. Let us profoundly hope, therefore, that the year 1933 will witness an extension of the habit of getting together and co-operating for the common good of the entire industry.

British Overseas Electrical Trade in 1932

A drastic reduction in imports

THE December returns issued by the Board of Trade show that the falling-off in our electrical imports persisted to the end of the year—in fact, the total was little more than half that of December, 1931. On the other hand, there was a ten per cent. increase in electrical exports during the month, both as compared with the preceding month and with December, 1931.

Two items were mainly responsible for this welcome rise—telegraph and telephone apparatus and unenumerated electrical machinery. Batteries and accumulators, too, made a component. The greatest proportional fall appears to have been in batteries and accumulators (if we except the special case of submarine cables); for some months foreign articles of this class have been inconspicuous in dealers' windows. Lamps are another item which show a substantial decline in value. Here there must have been some drastic price-cutting, for the actual number imported rose from 47 to 50 millions! In contrast to this, imports of carbons fell from 376 to 59 millions.

Turning to the export figures it will be seen that although

Table I.—Exports and Imports during December, 1932

	EXPORTS			IMPORTS			RE-EXPORTS		
	Electrical Exports for Dec., 1932.	Inc. or dec. as compared with Nov., 1932.	Inc. or dec. as compared with Dec., 1931.	Electrical Imports for Dec., 1932.	Inc. or dec. as compared with Nov., 1932.	Inc. or dec. as compared with Dec., 1931.	Electrical Re-exports for Dec., 1932.	Inc. or dec. as compared with Nov., 1932.	Inc. or dec. as compared with Dec., 1931.
Insulated wires and cables ...	£79,320	− £19,125	− £7,473	£25,464	− £4,820	− £32,865	£187	− £173	− £148
Electric carbons ...	664	− 786	− 4,638	9,094	− 448	− 17,621	—	− 95	− 325
Arc lamps and searchlights ...	432	− 73	+ 12	—	− 118	− 63	—	− 60	− 6
Incandescent lamps ...	35,373	+ 5,476	+ 10,466	21,493	− 4,237	− 12,900	892	− 100	+ 37
Other lighting apparatus ...	30,068	+ 5,874	− 2,522	31,382	+ 3,235	− 13,605	4,013	+ 2,418	+ 3,215
Batteries and accumulators ...	68,183	+ 6,513	+ 20,768	3,852	− 1,911	− 23,166	181	− 110	− 298
Meters and instruments ...	20,102	+ 3,432	− 3,572	27,412	− 8,710	− 2,119	915	− 468	+ 186
Unenumerated electrical goods and apparatus	76,904	− 5,110	− 25,827	52,407	− 7,368	− 42,448	2,778	+ 305	− 1,398
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cables (not submarine) ..	13,868	− 7,116	+ 1,391	651	+ 210	− 737	12	− 6	− 56
Submarine telegraph and telephone cables	9,750	− 36,523	− 3,653	—	—	—	—	—	—
Telegraph and telephone apparatus	212,497	+ 61,543	+ 75,297	69,595	− 42,907	− 36,200	6,863	+ 3,310	+ 1,067
Electrical Machinery—									
Railway and tramway motors	23	− 281	− 3,517	—	—	—	—	—	—
Other motors and generators ..	96,421	− 3,570	− 37,598	—	—	—	—	—	—
Unenumerated electrical machinery	239,359	+ 75,695	+ 70,105	47,264	+ 5,971	− 92,475	7,020	+ 1,699	− 294
Total	£882,964	+ £85,949	+ £89,239	£288,614	− £61,103	− £274,199	£22,861	+ £7,656	+ £1,980

big jump as compared with December, 1931, and shipments of lamps were also substantially greater. Cable exports as a whole were lower, largely due to the non-recurrence of a big item for submarine cable which figured in the November list. "Other motors and generators" and unenumerated goods and apparatus were down as compared with the corresponding month of last year.

The figures for the whole of 1932 (Table III) show in a

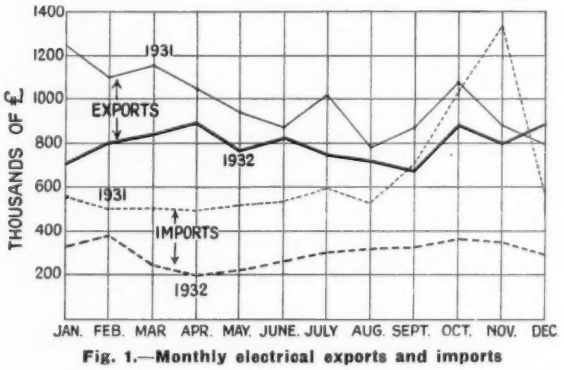


Fig. 1.—Monthly electrical exports and imports

striking way how imports have been curtailed by our departure from the gold standard and the introduction of import duties. The decline has amounted to no less than 56 per cent., and every item in the list contributed to it. The largest decrease occurred in the case of telegraph and telephone apparatus; this includes radio material which is probably the largest

there was a fall in the total, it amounted to only 19 per cent. (against the decline of 56 per cent. in imports), while four items actually showed increases. There was a substantial reduction in machinery exports, amounting in total to £670,500, due almost entirely to smaller shipments of "other motors and generators." Unenumerated goods were considerably down, as were also cables and telegraph and telephone apparatus.

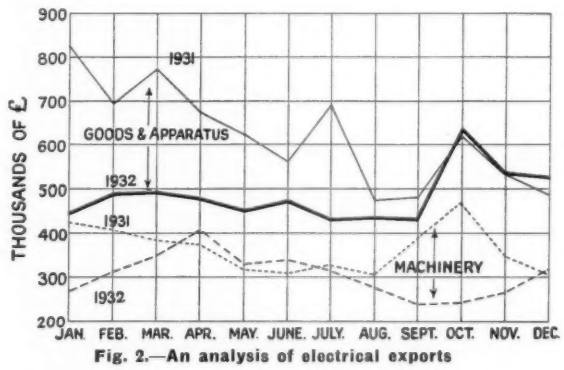


Fig. 2.—An analysis of electrical exports

The machinery exports are analysed in Table II, which also gives the weights of shipments, a much better indication of the trend in these days of fluctuating values. The table shows that while the total value declined by 15.4 per cent., the tonnage was only 9.8 per cent. lower. In other words, the "unit" price fell from £160 to £150 per ton. Owing, probably, to the

Table II.—Exports of Electrical Machinery

Destination.	QUANTITIES.			VALUES.		
	1931.	1932.	Inc. or dec.	1931.	1932.	Inc. or dec.
	Tons.	Tons.	Tons.	£	£	£
European Countries	7,183	9,045	+ 1,862	1,271,917	1,403,730	+ 131,813
Japan	113	41	− 72	25,106	12,504	− 12,602
South America	2,196	1,052	− 1,144	369,299	190,744	− 178,555
South Africa...	2,395	3,215	+ 820	378,920	439,722	+ 60,802
British India	4,330	5,383	+ 1,053	713,497	748,594	+ 35,097
Australia	912	832	− 80	133,042	139,035	+ 5,993
New Zealand	1,252	620	− 632	208,994	107,245	− 101,749
Canada	2,086	1,151	− 935	270,914	154,850	− 116,064
Other Countries	6,780	3,238	− 3,542	986,148	490,913	− 495,235
Total	27,247	24,577	− 2,670	£4,357,837	£3,687,337	− £670,500

peculiar exchange position, while a lower tonnage was exported to Australia, its sterling value was higher. On the whole the electrical machinery export trade was not unsatisfactory. It is noteworthy that purchases by European countries showed an increase, and it is good to see that exports to South Africa, India, and Australia were maintained. New Zealand's share, however, was halved, due no doubt to the slowing down of hydro-electric development in the Dominion. South America and Canada were not such good customers.

The accompanying curves give a good indication of the fluctuations of our electrical trade during the past two years. Fig. 1 traces both imports and exports during that period and it will be seen that so far as the latter were concerned a bad start last year was recovered very well and a fairly even course was pursued with a rising tendency at the close of the year. The import total was maintained evenly between £200,000 and £400,000; the high jump in November, 1931, was not repeated.

The main feature of fig. 2 is the revelation that the exports remained high at the end of last year only because of the strong tendency of goods and apparatus; machinery exports were well down as compared with 1931. Fig. 3 shows that the same applied to imports.

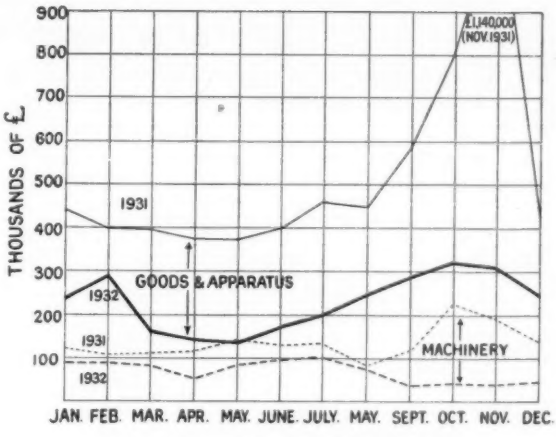


Fig. 3.—An analysis of electrical imports

Table III.—Exports and Imports during December, 1931 and 1932

	EXPORTS.			IMPORTS.			RE-EXPORTS.		
	1931.	1932.	Inc. or dec.	1931.	1932.	Inc. or dec.	1931.	1932.	Inc. or dec.
Insulated wires and cables	£1,416,035	£1,095,798	– £320,237	£770,155	£299,009	– £471,146	£12,923	£2,208	– £10,715
Electric carbons	22,515	25,919	+ 3,404	231,050	95,339	– 135,711	3,181	1,212	– 1,969
Arc lamps and searchlights	6,753	7,365	+ 612	2,993	1,627	– 1,366	685	468	– 217
Incandescent lamps	346,239	375,297	+ 29,058	471,517	167,036	– 304,481	5,826	6,839	+ 1,013
Other lighting apparatus	381,013	306,960	– 74,053	609,746	247,570	– 362,176	13,152	20,629	+ 7,477
Batteries and Accumulators	704,282	641,880	– 62,402	629,343	90,118	– 539,225	15,478	21,326	+ 5,848
Meters and instruments...	311,909	287,749	– 24,160	388,123	338,522	– 49,601	7,872	5,469	– 2,403
Unenumerated electrical goods and apparatus	1,545,811	977,139	– 568,672	1,171,995	627,159	– 544,836	62,957	37,490	– 25,467
Telegraph and Telephone Cable and Material —									
Telegraph and telephone wires and cables (not submarine)	469,435	222,760	– 246,675	29,435	5,418	– 24,017	2,745	626	– 2,119
Submarine telegraph and telephone cables ...	169,314	196,950	+ 27,636	24,100	—	– 24,100	—	—	—
Telegraph and telephone apparatus	2,064,638	1,710,553	– 354,085	1,911,313	864,694	– 1,046,619	90,557	48,441	– 42,116
Electrical Machinery—									
Railway and tramway motors	81,157	64,384	– 16,773	—	—	—	—	—	—
Other motors and generators	1,762,490	1,164,264	– 598,226	—	—	—	—	—	—
Unenumerated electrical machinery	2,514,190	2,458,689	– 55,501	208,159	102,746	– 105,413	116,265	85,195	– 31,070
Total	£11,795,781	£9,535,707	– £2,260,074	£6,447,929	£2,839,238	– £3,608,691	£331,641	£229,903	– £101,738

The Contractors' Dinner

A DISTINGUISHED company attended the annual dinner of the Electrical Contractors' Association at the Savoy Hotel, London, on Tuesday last. Mr. W. B. Williams, president of the Association, was in the chair.

Sir Andrew Duncan, chairman, Central Board, proposed "The Allied Associations and Honorary Officials." He said that for five years the Board had been engaged upon construction; now it was about to establish itself as a trading concern, and it was desirable that all sections of the industry should get together. When the grid was complete British industry would have a flexible and highly efficient production machine not equalled in any other country. By concentrating generation in the most efficient stations and doing away with unnecessary surplus plant the average cost of electricity would be reduced and distribution would be expedited and cheapened by the key tapping points established in all parts of the country. National and area consultative committees had been set up to survey the whole field of public relationships with a view to promoting the electrical welfare of the community, and he looked forward to a happy result from the committees' deliberations. He invited the contractors to co-operate in these efforts and he was confident that they would assist.

There were great opportunities and every individual in the industry had a common goal at which to aim. He had noticed from the E.C.A.'s Year Book that it had no Scottish branch; he hoped that it would soon become "international" by joining up with the Scottish Association.

Committee "D"

Mr. W. B. Williams, in the course of his reply to the toast, also stressed the need for unity in the industry. He pointed out that Committee "D" set up by the Electricity Commissioners provided an unparalleled means of getting rid of discontent and discord. The industry was thoroughly well organised in its many sections; what was needed was that these sections should get together to ensure a reasonable measure of security and reward for every worthy worker within the fold. Too many electrical men had the idea that their services must be given practically for nothing. There was too much of a "business-at-any-price" attitude—even among manufacturers. This only resulted in injury to the industry and poor public service. The electrical contractor had always been in the forefront of electrical development but opportunities were diminished by inadequate mains and high rates. A wild scramble for business would benefit no section of the industry and the public would only get cheap and indifferent work.

Proposing the health of the guests, Mr. R. Grierson said that if the saying that a man is known by the company he keeps applied to associations, the E.C.A. was a very respectable body indeed! Referring to co-operation in the building industry, he said that nowadays if a building was to be a success the architect and the electrical engineer worked hand in hand. Old lady Electra had a numerous family; he counted up seventeen sons, but only one daughter—the E.A.W.—which was doing most useful work. Mentioning the industrialists present, he said that he often wondered how the course of the electrical industry would have gone if Sir Hugo Hirst had decided to devote himself to some other field. Mr. Grierson avowed that there was a body known as the Electrical Retardation Association at work to make things as difficult for the consumer as possible.

A Mere Consumer

Sir William Ray, M.P., L.C.C., responding, said that in these dark and dreary days it was encouraging to see such prosperity as was evident in the electrical industry. He was one of the unfortunate class generally known as "the consumer." Speaking in this capacity, he stressed the need for proper wiring regulations and insistence upon work being carried out only by qualified men. A greater measure of standardisation was necessary in the matters of supplies, appliances and charges. He deprecated the recrudescence of the Luddite sentiment which blamed mechanisation for the existing unemployment. On the other hand, improvement in industrial efficiency opened up new fields. Among the causes of unemployment were the invasion of industry by women and the cessation of emigration. Great relief would be obtained by a curtailment of public expenditure.

Sir Felix Pole (Associated Electrical Industries, Ltd.), was inclined to agree with Mr. Williams that the manufacturers practically gave their products away. He pointed to the good and cheap job which they had provided in the grid. He welcomed Sir Andrew Duncan's statement that the Central Board was concentrating on the extensive development of distribution; in this the contractors would play a great part. They had to educate the public, and in this direction the E.A.W. was doing splendid work. The largest selling organisations were housed in attractive buildings and the electricity supply industry must follow suit.

Mr. T. E. Alger (past-president) proposed the president's health, and Mr. Williams briefly responded.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources, Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

A Cable Company's Suggestion Scheme

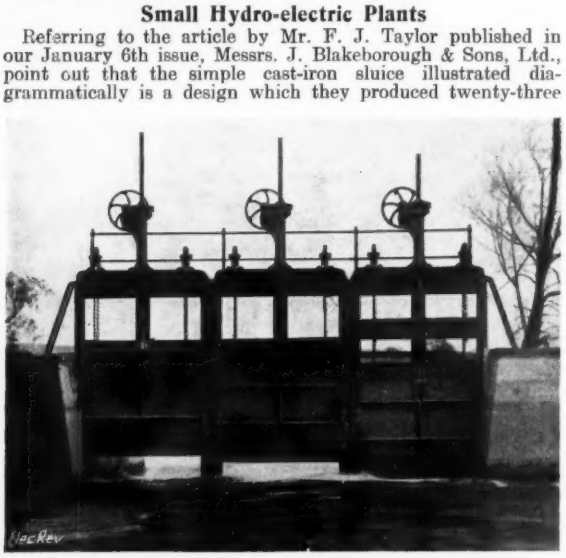
Referring to the remarks on suggestion schemes in our last issue, Mr. J. H. C. Brooking, the managing director of the Croydon Cable Works, Ltd., has sent us a copy of a suggestion sheet which is in use by his company. He tells us that during the past three years they have received over 140 suggestions from their employés, of which a fair proportion have been useful. As a rule, they do not pay for anything that is unsuitable, but occasionally they reward an employé for a good idea which may not be immediately applicable as an appreciation of his trouble.

Opposition to Peterborough Showrooms

At a recent meeting of the Peterborough City Council the Electricity Committee reported that it had received a deputation from the Tradesmen's Association, and the Electrical Contractors' Association, objecting to the opening of an electricity showroom in Bridge Street. The Committee resolved that the establishment of the showroom be left to the Sub-Committee appointed, that the Peterborough Tradesmen's Association be told that the Committee had decided to establish a showroom, and that the Electrical Contractors' Association be informed that the proposals outlined by them would be given consideration in due course.

Small Hydro-electric Plants

Referring to the article by Mr. F. J. Taylor published in our January 6th issue, Messrs. J. Blakeborough & Sons, Ltd., point out that the simple cast-iron sluice illustrated diagrammatically is a design which they produced twenty-three



An installation of Blakeborough sluice gates

years ago. They have sent us the picture which accompanies this note showing the actual installation in which it was employed. Messrs. Blakeborough have been manufacturers of sluice gates and penstocks for over a century and are one of the most prominent concerns in this class of work.

E.D.A. Activities

The fifth electrical carnival of the British Electrical Development Association in aid of the I.E.E. Benevolent Fund and the Electrical Trades' Benevolent Fund was held in the Oxford Galleries, Newcastle-on-Tyne, on January 13th.

There were many prominent representatives of the electrical industry present including Mr. R. P. Sloan (managing director of the North-Eastern Electricity Supply Co.), and his daughter Miss Sloan, Mr. and Mrs. W. F. T. Pinkney and party, Colonel and Mrs. S. E. Monkhouse and party, Mr. and Mrs. C. W. Legg (Leeds), Mr. and Mrs. W. Horsfall, Mr. and Mrs. C. W. Salt (Carlisle), Mr. and Mrs. S. Tillotson (West Hartlepool), Mr. and Mrs. F. A. Orchard, Mr. and Mrs. A. Parkin, Miss Anna Holm, and Mr. and Mrs. A. A. Hughes.

A very gratifying response has been obtained to the E.D.A. Public Speaking Competition in the London and South-East England Area. Fifty-three entries have been sent in by men and nine by women employed in the industry. In view of the number of men competing, it has been arranged to hold eight eliminating competitions, the winners of which will compete in the final competition for the area. These eliminating competitions will be held on the following evenings at 7 p.m.: E.D.A. Offices, 2, Savoy Hill, W.C.2, January 23rd and 27th; County of London Electric Supply Co., Showrooms, 1 & 2, Astoria Parade, Streatham, S.W.16, January 25th and 26th; G.E.C., Magnet House, Kingsway, W.C.2, January 26th and 27th; Hackney electricity showrooms, 18, Lower Clapton Road, E.5, January 24th and 25th.

Each eliminating competition will be judged by two of the following: Messrs. A. J. Fuller, R. W. Kennedy, J. H. Lepper, A. E. McKenzie, H. Marryat, W. L. Randell, A. L. Robinson, and Councillor G. Green. The final competition for men will be held at the E.D.A. offices on February 1st at 7 p.m. before Sir James Hawkey, J.P., and Messrs. F. Webster and R. S. Downe. It is hoped to arrange for all the women competitors to compete on the evening of February 3rd, when the judges in this case will include at least two well-known ladies.

The E.D.A. Public Speaking Competition Committee, under the chairmanship of Mr. J. C. Dalton, who are responsible for these arrangements, hope that many people in the industry will support this competition by attending the meetings.

A Water-heating Conference

A conference of supply engineers of the North Midland Area of the E.D.A. was held at Leeds on January 10th and was attended by forty-seven representatives from all parts of Yorkshire and Lincolnshire. Mr. N. McLean (Harrogate) presided, and he was supported by Mr. S. E. Fedden (C.E.B.). The speakers included Messrs. J. I. Bernard (E.D.A. headquarters), J. R. Longman (C.E.B.), P. Honey (Croydon), C. E. Allsopp (Bradford), E. A. Mills (Halifax), T. W. Hibbert (Doncaster), D. Bellamy (Hull), and R. McCourt (Harrogate). The following resolution was carried unanimously: "That this conference of engineers of supply undertakings in the North Midland Area unanimously agrees that the use of electricity for water heating constitutes a large potential load which will be of great value to all supply undertakings, and that to ensure the rapid development of this class of business it is essential that supply undertakings should take the lead and arrange for hire, or hire-purchase, facilities, and the appointment of water heating specialists on their staffs."

Fires for Nothing

An amusing competition has been concluded by the Sales Department of the Electricity Supply Board of the Irish Free State. Every consumer was invited to mark a voting paper according to his idea of the relative values of nine given selling points in the sale of electric fires. The Board marked a list with its own preferences, and offered free fires to those competitors whose voting papers corresponded with the sealed list. In view of the colossal number of possible combinations, it is not surprising that the prizes had to be awarded to two persons whose lists were "nearest to being correct." Exact correspondence would have amounted to a miracle.

Order of Preference.	Selling Points.
3	Cleanliness
1	Convenience
6	Economy
4	Efficiency
8	Hygiene
5	Immediate Heat
2	Portability
9	Safety
7	Simplicity

The sealed list was marked as shown herewith.

This competition might be made of real value for salesmen if the voting papers were to be analysed in the manner of a proportional representation election, if the numbers voting made the effort worth while.

Dutch Radio Exports

The Central Statistical Bureau reports that the exports of radio apparatus in 1932 amounted to 6,358 metric tons of a total value of 38,437,000 fl. as compared with 48,559,000 fl. (8,476 tons) in the previous year and 66,328,000 fl. in 1930. Wire filament lamps accounted for 7,478,000 fl. in 1932, 13,302,000 fl. in 1931, and 22,922,000 fl. in 1930.

Catalogues Required

Mr. A. G. Mead, late of Mead & Jeffery, Ltd., has commenced business at 10, The Broadway, Ealing, W.5, as a wholesale electrical supplier as the Mead Electrical Co. He asks for catalogues (with wholesale prices) from manufacturers and merchants of electrical and radio equipment.

Mr. Edward Carter, A.M.I.E.E., formerly engineer to the Northern Electrical & Ventilating Co., Ltd., Liverpool, has opened premises as an electrical contractor at 13, Hackins Hey, Dale Street, Liverpool; he asks for trade lists, &c.

Mr. G. Mackenzie (the Home Electrics) is opening premises at 22-24, Commercial Street, Dundee, and asks for catalogues of domestic electrical apparatus.

Messrs. Twentyman & Willmott, Ltd., electrical contractors, have opened a branch office at 40-41, Water Street, Birmingham, 3, and ask for suppliers' catalogues.

Mr. D. Hooper has commenced a business in electrical supplies at 48, Baxter Gate, Loughborough, and asks for manufacturers' catalogues and price lists.

Advertising Technical Products

Mr. T. Birkett addressed the Advertising Club of Birmingham on January 12th on "Advertising Technical Products," and his remarks dealt almost exclusively with electrical apparatus. He said that the problem of the manufacturer was to sell to the expert electrical engineer who knew exactly what he wanted. By good advertising and salesmanship it was possible to persuade the public to buy more of a particular

product, but an electrical engineer would not buy more articles than he needed or could use. The first step to be taken when advertising technical products was to make the products familiar by advertising in the technical papers, by catalogues and direct mail, and the second step was to call on the user and the potential user from time to time.

A product with a very small appeal could only be advertised in the technical papers, but even technical papers varied and had slightly different appeals so that care must be exercised when choosing the medium. Mr. Birkett said that it often seemed that too many technical papers contained advertisements which did not advertise, and which seemed to be read only by trade rivals. He appealed to the electrical engineer and the advertising expert to co-operate and produce advertisements which were readable and effective. A good catalogue, reinforced with regular sales letters, was perhaps the best method of advertising technical products. The sales letters should vary, for obviously the sales letter which interested the wholesaler or contractor would not interest the consultant or the manufacturing electrical engineer.

His own firm kept graphs of sales and found that whenever a product in a particular group was extensively advertised the curves of other groups rose suddenly. Every small account opened in bad times was a potential large order in better times.

The E.C.A. (West Yorks Branch) Dinner

The annual dinner of the West Yorkshire Branch of the Electrical Contractors' Association was held at Leeds on January 10th. Mr. Longman, who responded to the toast of "The Electricity Industry," proposed by Ald. C. V. Walker, said the result of the establishment of the grid was that British electrical manufacturers were now in a position to compete with the world in the production of any type of apparatus that might be required. Speaking of the tremendous scope of the industry, Mr. Longman pointed out that radio itself employed some 50,000 people, and it had brought about a very large increase of electrical installations in private houses. This increase opened the way to many other possibilities, and it behoved electrical contractors to make a good job of the installations.

Mr. W. B. Williams, president of the Association, responding to the toast of "The Association," proposed by the Deputy Lord Mayor of Leeds (Ald. Eric Clarke), emphasised that the organisation was not a "trade ring" to keep up prices. Its aim was to encourage good craftsmanship, the use of good standard quality material, and to maintain a proper standard of wages. He complained that in the South, at any rate, certain contractors used any sort of material at the very lowest price, and they also employed the cheapest labour they could possibly get. That was not the way to ensure satisfactory installations.

Mr. J. Gaunt Craven proposed the guests, and Mr. C. F. Partridge, head of the Electrical Engineering Department of the Leeds Technical College, replied.

Large Testing Transformers for Callender's

The accompanying picture shows the arrival of the first unit of a very large research transformer equipment, at the new research laboratories of Callender's Cable & Construction Co., Ltd., at Wood Lane, Shepherd's Bush. This equipment consists of two transformer units, each giving 500 kVA at 500 kV. The transformers can be cascaded, thus giving an output of 1,000 kVA at either 1,000 kV or 500 kV. These ratings are continuous, the short-time ratings being double these values. It is claimed, therefore, that this is the largest transformer equipment for these voltages to be installed in this country. The transformers were supplied filled with oil, each weighing 45 tons. These units form only one portion of a comprehensive equipment, which is being laid down at the laboratories, which are being designed to facilitate the study of every phase of work associated with the development of high-voltage cables.

Trade Announcements

Messrs. J. A. Brook have moved to Lord Street, Huddersfield.

The Hotpoint Electric Appliance Co., Ltd., has removed its Southampton branch to 3, East Street, Southampton.

Messrs. Halladay's, Ltd., Birmingham, have appointed Mr. P. B. Jones, 54, Fetter Lane, E.C.4, as London agent for their metal switch plates.

Messrs. R. & J. Park, Ltd., Dominion Works, Thames Road, Chiswick, W.4, have been appointed sole concessionaires for "Premier" electric cleaners.

Mr. S. F. Philpott has severed his connection with Messrs. Adkins & Philpott, and is now in business on his own account as the S.F.P. Electrical Co., North Bar Works, Banbury, Oxon.

A G.E.C. Display Board

A striking illuminated display board is now offered free by the General Electric Co., Ltd., to electrical contractors and retail traders who stock the new line of "Magnet" electric torches. This board, as will be seen from the illustration, is suitable for window or counter use and is fitted with clips to take a representative range of the company's "Bakelite" torches. A central feature of the board is a large illuminated bull's eye.

A "Magnet" torch display board

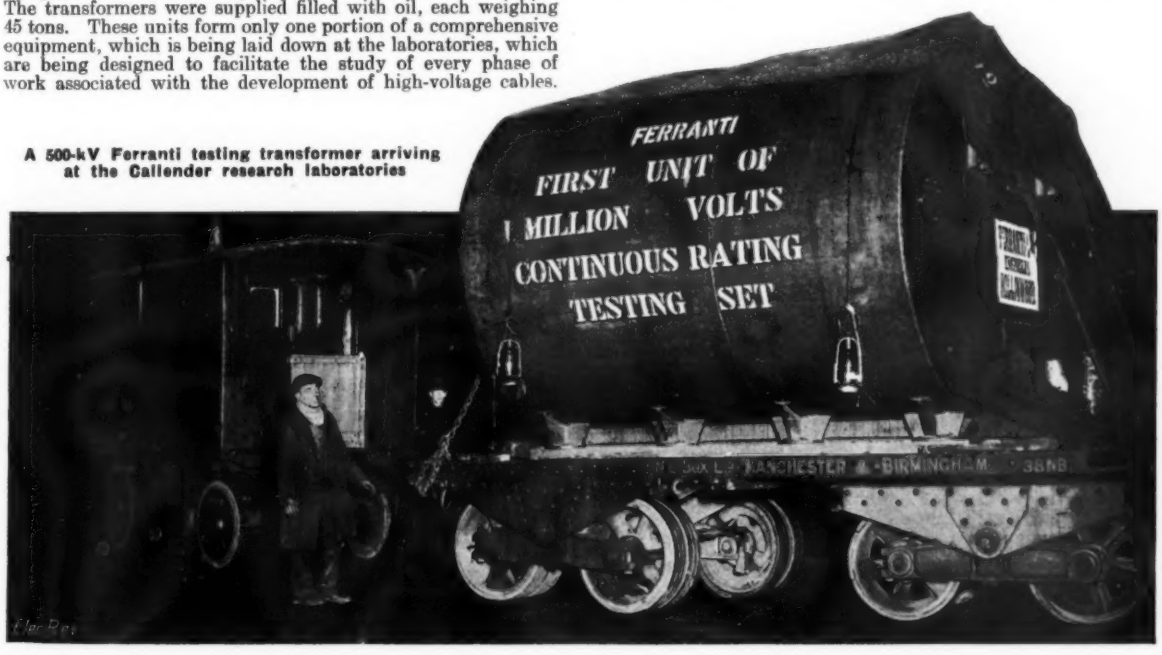
Social Events

The G.E.C. Dramatic Society, whose performance of "The Sport of Kings" at the Guildhall School of Music in April last resulted in a donation of £96 to the funds of the Infants' Hospital, Vincent Square, Westminster, has chosen the comedy "Leave it to Psmith," by Ian Hay and P. G. Wodehouse, for two performances which will be given at the Fortune Theatre on April 3rd and 4th. The proceeds will again be given to the Infants' Hospital.

The seventh annual staff dinner of Enfield Cable Works, Ltd., was held on January 14th at the Midland Grand Hotel, London, Mr. F. Plutte (managing director) presiding in the unavoidable absence of the Earl of Verulam (chairman of the company). In proposing "The Enfield Cable Works, Ltd.," Mr. P. F. Deakin said that there were now 550 employés at the works, 5 per cent. of whom had been with the company since its foundation in 1914, while 35 per cent. had from ten to fifteen years' service. The past year had been one of consolidation and preparation for the good time that was bound to come. Outstanding features of the year were developments in gas-pressure cables and at the rolling mills.

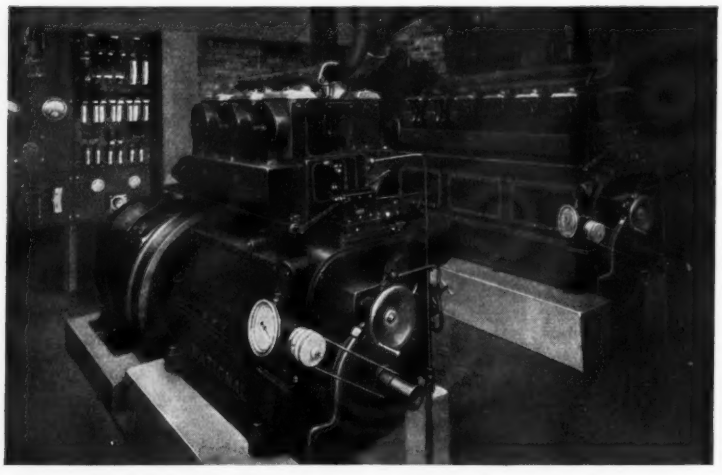
Mr. F. Plutte, in the course of his response to the toast, referred to the early days of the company, when the war broke out, and when its destiny was so uncertain. The Earl of Verulam came to his aid, and it was largely due to his help that the company survived. They could face the future with the knowledge that they had the hearty co-operation of the staff. Mr. F. Plutte, Jun., proposed the health of

A 500-kV Ferranti testing transformer arriving at the Callender research laboratories



the guests in a witty speech, and Mr. B. M. Davison responded. Dr. E. Bowden, in proposing the chairman's health, paid a tribute to Mr. Plutte. During the dinner a musical programme was given by Mr. A. V. Dean's orchestra, which also played for the dancing that followed.

The annual social of Fylde branch of the Electrical Contractors' Association attracted a large company in spite of the influenza epidemic which prevented many attending. This was the second annual venture; Mr. George Ollier presided,



" National " heavy-oil engines at the Northern Greyhound Racing Track

and there were over 200 people present. Among the guests were Mr. C. Furness and Mrs. Furness. Messrs. R. Darbyshire and H. Seddon acted as whist M.C.s, with Mr. G. Nelson in charge of the dancing.

Mr. J. T. H. Legge, managing director of the South Wales Electric Power Co., speaking at the recent annual staff dinner held at Pontypridd, said that during the last two years approximately seventy-five miles of transmission lines had been erected, and over twenty miles of l.p. mains laid down. The number of sub-stations had increased by sixty-nine, and the increase in output was proceeding at a satisfactory rate. During the past two years over a quarter of a million had been spent in widening the distribution area and in putting in additional transmission lines. Some more contracts had been booked lately which would result in a very considerable increase in output.

Mr. C. T. Allan, assistant manager, presided, and others present included Mr. J. Colenso Jones, M.B.E., chairman of the Pontypridd Urban District Council, Alderman A. E. Gough, chairman of the Cardiff Electricity Committee, and Mr. R. Roper, the resident engineer in charge of the company's station at Upper Boat.

Electrical Showroom Training for Women

At a conference presided over by the president of the Electrical Association for Women, held at the I.E.E., in October, 1931, a proposal to place the woman demonstrator on a permanent and recognised basis was considered, and a Diploma in Electrical Housecraft was devised. During the course of the discussion as to the qualifications for the diploma, the question of training arose, and it was decided to ascertain what training schemes were at present in existence in the electrical industry. For this purpose a questionnaire was drawn up and issued to all sections of the industry. A committee formed of representatives of the electrical and educational worlds has completed its report on the replies received, and this is now published in booklet form by the E.A.W. (price 6d.). This booklet also includes extracts from remarks which appeared informative or interesting, while a list of those who participated in the inquiry is also given. Appended to the report is a suggested scheme, prepared by the Committee, of showroom training for the woman demonstrator and saleswoman.

Works Visits

The Victor works of the Automatic Electric Co., Ltd., were recently visited by the principals in the pantomime " The Sleeping Beauty," now being played at the Empire Theatre, Liverpool. In the accompanying illustration are Mr. G. S. Melvin, Miss Nora Bancroft, Mr. Billy Denvers, and Miss Eve Gray, who cooked a meal with one of the latest " Xcel " cookers. The visitors inspected the various processes in the manufacture of " Xcel " appliances and concluded their tour with a visit to Broadgreen Hall, a mansion which now serves as club premises for the company's employés.

A party of thirty-two students of the University of Capetown, who are at present touring industrial centres in this country, visited the works of the English Electric Co., Ltd., at Bradford, on January 14th, following a visit the previous afternoon to the Bradford Municipal Technical College.

Recent Contracts

Messrs. Benham & Sons, Ltd., have secured the order for the cafeteria equipment of the Sharikoposhipnick Works in Moscow, which is said to be the largest ball-bearing factory in the world. This will be the first equipment of its kind fitted up in Russia, and the order was obtained in competition with leading American firms. The equipment will include steam-heated and electrically heated service fittings, carving tables and bain-maries, cold counters, pressure water boilers, for tea-making, tea and coffee urns, dishwashing and stacking tables, gravity and motor-driven conveyors and a large steam-heated cabinet hot closet.

The generating plant at the Northern Greyhound Racing Track, Hanley, consists of three heavy-oil engines (aggregating 189 h.p.), made by the National Gas Engine Co., Ltd., driving Crompton Parkinson 240-V d.c. generators. These engines are totally enclosed with patent cylinder heads containing horizontal valves which are quickly removable without breaking pipe joints. Lubricating oil is supplied under pressure, and starting is by compressed air. Two sets, 80 by 40 kW, run in parallel to provide 80 kW for lighting (which includes one hundred 300-W lamps on the track), 10 kW for heating, and 25 kW for the hare. The load fluctuates by 30 kW at least a dozen times during the 90-sec. run of the hare in each event, without causing voltage fluctuation. A 3-kW set provides lighting for the kennels. The larger engines run for 18 hr. per week; crude oil (8½ cwt.) costs £1 14s. and lubricating oil 5s., which works out at 0.33d. for each of the 1,400 kWh generated. The engines are left unattended. The plant was erected by Messrs. T. M. Birkett & Son, Ltd., of Hanley.

Fittings made and supplied by the General Electric Co., Ltd., have been employed for the new lighting installation at All Saints' Church, Southport. They have been designed to conform with the Gothic style of the church. The main body of the church is lighted by means of six 3,000-W lanterns, suspended over the aisles, and a large 500-W lantern in the centre of the building. There are also two 300-W lanterns in each of the north and south transepts, making a total of eleven fittings in all. The lanterns are fixed well up and they give an even diffusion of light over the whole of the building. An effective system of dimming serves the installation.

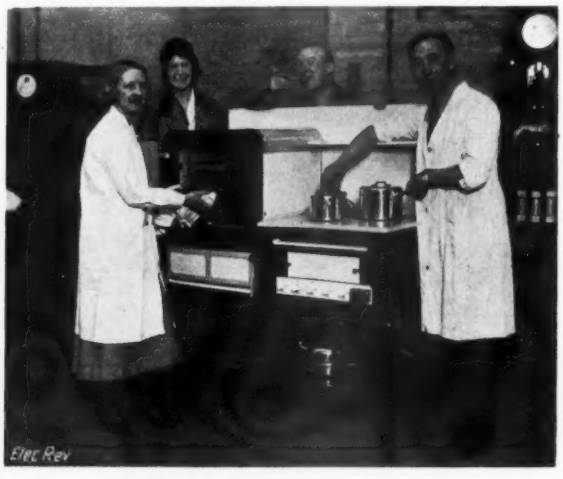
Similar, but smaller, lanterns have been fixed in the four porches, whilst in the main vestibule there is a ceiling unit with flame coloured lamps. At the entrances there are lanterns of heavy obscured glass. Over the pulpit is a special fitting also with a flame coloured lamp, and the whole of the woodwork in the chancel, including the choir stalls, light oak, and the choir stalls are illuminated by lights fitted in the tops of the stalls. At the communion table end special trough and reflector lighting has been installed. The whole of the installation work was carried out by McGoff and Vickers, Ltd., Liverpool.

Messrs. Marryat & Scott, Ltd., were responsible for the installation of an electric passenger lift in the new stand at the Arsenal Football Club's ground which was described in a recent issue.

The new health centre and school clinic (Moreton) which has been erected for the Wallasey Corporation, is heated by " J.P." equipment installed by the J. P. Tubular Heating Co., Ltd.

The British Industries Fair

In addition to the names of exhibitors given in our last issue we are informed that the following companies are participating: Linolite, Ltd., the Scotoid Co., Ltd., and the Foster Instrument Co. The Staines Kitchen Equipment Co., Ltd., informs us that it will not have a stand at this year's Fair although its name appeared in the preliminary list.



Stage stars cook by electricity

Calendars and Diaries

Mr. Geo. Barnard, 1, Mile Street, Birmingham, has sent us a pocket diary neatly bound in brown leather, and a refill calendar pad for 1933.

Avon Tin Printers, Ltd., has sent us a wall calendar with large monthly slips.

The calendar for 1933 received from the Hackbridge Electric Construction Co., Ltd., has a photograph showing the shipment of what is claimed to be the world's largest transformer (125,000 h.p.) made by the company.

New Catalogues and Lists

Bruce Peebles & Co., Ltd., Edinburgh.—List No. 26, covering a range of squirrel-cage induction motors.

Marconiphone Co., Ltd., 210-212, Tottenham Court Road, W.—An illustrated broadsheet describing the new Marconiphone model 254 radio-gramophone.

John Shaw & Sons, Wolverhampton, Ltd., Wolverhampton.—List No. 1/33, giving particulars and prices of electrical accessories. Illustrated.

Brook Motors, Ltd., Empress Works, Huddersfield.—An abridged stock list (No. 341) of a.c. motors.

Asea Electric, Ltd., 5, Chancery Lane, W.C.—An illustrated pamphlet describing the company's cables, with tables of dimensions, &c.

L. Weekes (Luton), Ltd., Luton.—A catalogue containing particulars of air-break and oil-immersed circuit breakers. Also a leaflet describing a watertight plug, socket, and ground box which the company has recently designed for use with electric cranes on docks, &c.

Craven Bros. (Manchester), Ltd., Reddish, Stockport.—The first number of "The Craven Machine Tool Gazette," a quarterly journal, containing among other things articles on the company's activities and its products.

Normand Electrical Co., Ltd., 3, North Side, Clapham Common, S.W.—List No. 1132, giving particulars and prices of geared and ungeared small motors from ¼ to 1 h.p.

Thomas Broadbent & Sons, Ltd., Huddersfield.—A pamphlet (No. 27), describing an improved type of direct electrically operated centrifugal of the over-driven type.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances :—

CHEMICALS, Etc.	Price Jan. 18th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£40	—
a Ammonia, Muriate (large crystal) ... ,,	£38	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£19 15s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac T.N. ... ... per cwt.	£8	—
a Sulphur Commercial... ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3¼d. to 3½d.	—
a ,, Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d.	—
METALS, Etc.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil ... ,,	1/2 to 2/9	—
p Babbits Metal and Anti-fiction Metals—		
Grade I ... ... per ton net	£137	£3 dec.
Grade II ... ... ,,	£97	£2 dec.
Grade III ... ... ,,	£53	£1 dec.
c Brass (rolled metal 2" to 12" basis)... per lb.	7d.	—
c ,, Tubes (solid drawn) ... ... ,,	8¾d. to 9d.	—
c ,, Wire, basis ... ... ,,	7¾d.	—
c Copper Tubes (solid drawn)... ... ,,	9½d.	—
g ,, Bars (best selected)... ... per ton		
g ,, Sheet... ... ... ,,	£61	—
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£36 5s.	—
d ,, ,, Sheets ... ,,	£64	—
d ,, ,, Wire Rods ... ,,	£41	£1 dec.
d ,, ,, H.C. Wire ... per lb.	6¼d.	¼d. inc.
f Ebonite Rod ... ... ,,	1/3 to 1/6	—
f ,, Sheet ... ... ,,	1/3 to 1/6	—
s German Silver Wire ... ... ,,	2/2	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para fine ... ... ,,	4/9d.	—
i Iron, Pig (Cleveland No. 3)... ... perston	58/6	—
i ,, Wire, galve. No. 1, P.O. qual. ,,	£20	—
g Lead, English pig ... ... ,,	£12	5s. dec.
g Mercury ... ... per bot.	£10 5s. to £11	5s. inc
e Mica (in original cases) small ... per lb.	6d. to 3/6	—
e ,, ,, medium ... ,,	4/- to 8/-	—
e ,, ,, large ... ,,	8/6 to 17/6 & up	—
p Phosphor Bronze, plain castings ... ,,	1/1d.	—
p ,, ,, drawn bars & rods ,,	10¼d.	—
p ,, ,, rolled strip & sheet ,,	10¼d.	—
p ,, ,, wire ... ... ,,	11⅛d.	—
o Platinum ... ... per oz.	£8	10s. dec.
d Silicium Bronze Wire ... ... per lb.	7⅛d.	¼d. inc.
r Steel, magnet, in bars ... ... ,,	7½d.	—
g Tin, Block (English)... ... ... per ton	£146 to £148	£3 dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/1	—

Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

Dissolutions of Partnership

Taylor & Corkish, electrical engineers and radio dealers, 45, Lord Street, Fleetwood, and at Blackpool.—Messrs. F. Taylor and N. C. Corkish have dissolved partnership. Mr. Taylor will attend to debts and carry on the business.

C. & E. Laws, electrical and radio engineers, 59A, Railway Approach, East Grinstead.—Messrs. C. Laws and E. Laws have dissolved partnership. Mr. C. Laws will attend to debts and carry on the business.

Private Arrangements

Unicfon, Ltd., 23, City Road, London, E.C., wireless and electrical dealers, &c.—A meeting of creditors was held recently at the offices of Messrs. Howard Smith & Co., 16, City Road, E.C., when a statement of affairs was presented which disclosed gross liabilities of £5,260 and net assets of £175. An offer was submitted of 2s. 6d. in the £ payable as to two-thirds in cash, and one-third in three months, suitably guaranteed. It was decided to adjourn the meeting for seven days while a committee of inspection investigated the position, valued the stock and reported to the adjourned meeting. The following are creditors :—Crystalate Co., £430; Cossor, Ltd., £132; Mullard Wireless, £226; G.E.C., £152; Edison Swan Electric Co., £159; Bulger, Jas., £835; Collaro, Ltd., £417; Telsen, Ltd., £120; Ormond Eng. Co., £128.

Electrical & Radio Supplies, 39, Shirley Road, Addiscombe, wireless and electrical dealers.—A meeting of the creditors of the above was held recently at the offices of Mr. P. A. Gascoin, 1, Tanfield Court, Temple, E.C., when it was stated that the liabilities amounted to approximately £341, against net assets of £215. The creditors decided to leave the matter in the hands of Mr. Gascoin, who stated that he would get into touch with an accountant in the City, who would subsequently be appointed trustee of the estate, and the assets would then be realised and the proceeds distributed amongst the creditors *pro rata*.

Company Liquidations

S. G. Brown, Ltd.—Particulars of claims by January 27th to the liquidator, Mr. R. Mackay Peat, 11, Ironmonger Lane, E.C.

Whitchurch & Pangbourne Electric Supply Co., Ltd.—Particulars of claims by February 14th to the liquidator, Mr. H. Fraser, 4, Fenchurch Avenue, E.C.

Burndept Wireless, Ltd.—Meeting, February 15th, at 12-13, South Place, E.C., to receive an account of the winding-up by the liquidator, Mr. R. A. Hamlyn.

Central Electric Supply Co., Ltd.—Meeting, February 14th, at 19, Carnaby Street, Golden Square, W., to receive an account of the winding-up by the liquidators, Messrs. C. Parker and E. H. Barrenger.

Bankruptcy Proceedings

M. Landau, dealer in wireless goods, High Street, Camden Town, N.W.—The public examination was held on January 13th at the London Bankruptcy Court, the accounts showing total liabilities of £22,680 (ranking £13,572), and net assets of £4,476. Debtor stated that he commenced business in 1906. In 1931 he sold one of his businesses to a limited company for £750 in shares, and he acted as a director (without remuneration) until these bankruptcy proceedings were instituted against him last September. From 1929 to April, 1932, he carried on a similar business at 28, Junction Road, Highgate, and from December, 1931, another at 48, Great Titchfield Street, W. Those two concerns were sold in April, 1932, for £1,500 to another company, of which he also acted as a director (without remuneration). Until 1930 his businesses were successful, but they subsequently declined owing to trade depression, to which fact, coupled with heavy depreciation to the value of stock, heavy overhead expenses and interest on borrowed money, the failure was attributed. The examination was concluded.

L. C. Burgess, trading as "Nu-Life" Battery Rejuvenators, 805-6, Salisbury House, London Wall, E.C.—The public examination was held on January 13th at the London Bankruptcy Court, the accounts showing liabilities of £878, against assets of £2. The debtor stated that in September, 1931, he began business in partnership, the capital of £25 being provided by his partner. In the following month he agreed to pay his partner £225 for the latter's interest in the firm; the partnership was dissolved and he (debtor) continued the business alone until he was brought to the Court last October on the petition of a creditor. The failure was caused by lack of capital, to the payment to his late partner, to heavy advertising and overhead expenses, and to general trade depression. The examination was concluded.

George Howard (the Younger), 10, Alford Grove, Sprowston, Norfolk, electrical engineer and wireless dealer.—The public examination of this debtor was held at the Shirehall, Norwich, on January 10th. According to the statement of affairs lodged the gross liabilities amounted to £99, of which £60 was expected to rank for dividend. The debtor attributed his failure to insufficient trade and inability to collect accounts. The examination was closed.

G. W. Kempton (Radio Supplies), Coronation Buildings, Victoria Road, Elland.—Public examination, February 10th, at the County Court, Prescott Street, Halifax.

A. E. Hilton, electrician, 104, Carolgate Bridge, Retford.—First meeting to-day (Friday) at 1, St. Swithin's Square, Lincoln. Public examination February 2nd, at the Sessions House, Lincoln.

J. D. Drury, electrical engineer, 64, Brasenose Road, Bootle.—Trustee, Mr. C. Semper, National Bank Building, Fenwick Street, Liverpool, appointed January 5th.

L. H. Potter (Norwich Radio Co.), wireless retailer.—Receiving order made January 9th on debtor's own petition. First meeting January 21st, at 4, Eastbourne Place, Prince of Wales Road, Norwich. Public examination February 7th, at the Shirehall, Norwich.

R. Ramsden, wireless and electrical contractor, 29, Gibbet Street, Halifax.—Application for discharge to be heard February 16th at the County Court, Prescott Street, Halifax.

H. Bannister (H. Bannister & Co.), electrical goods factor, 48, Old Moat Lane, Withington, Manchester.—Trustee, Mr. N. McKellen, 20, Booth Street, Manchester, appointed January 10th.

R. O. Woodruff, electrical and radio engineer and contractor, 4, Bridge Parade, Godstone Road, Purley.—First and final dividend of 1s. 6½d. in the £, payable January 20th at the Official Receiver's offices, 29, Russell Square, W.C.

Electricity Supply

Lighting, Domestic, Power

Aberayron.—STREET LIGHTING.—An agreement has been sealed between the Urban District Council and the Aberayron and District Electricity Supply and Power Co., Ltd., for street lighting covering a period of three years and for a minimum number of fifty lamps at £2 12s. 6d. per lamp per season.

Alyth (Perthshire).—ELECTRICITY FOR STREET LIGHTING.—At the last meeting of the Town Council it was reported that the Lighting Committee had met representatives of the Grampian Electricity Supply Co. and of Messrs. Balfour, Beattie & Co., and had arranged for street lighting by electricity.

Belford (Northumberland).—OVERHEAD EXTENSIONS.—The Rural District Council has been informed by the North Eastern Electric Supply Co., of its proposals to place overhead lines at Bamburgh, Beadnell, North Sunderland and Seahouses. The company proposes to reconstruct and extend its network at these places and is making application to the Ministry of Transport for consent. Some objection has been raised by the Council to the proposal to run the poles up the main street of Bamburgh, a picturesque resort.

Belgium.—HIGH-PRESSURE BOILERS.—Following the example of the Société des Centrales Electriques des Flandres et du Brabant, which has been using boilers generating steam at a pressure of 50 atmospheres at its power station at Langerbrugge for a considerable period, the Société de l'Union des Centrales du Hainaut has recently installed at its generation station at Quaregnon in the Borinage a battery of boilers generating steam at a pressure of 55 atmospheres for use with an Alsthom 45,000-kW turbo-alternator running at 3,000 r.p.m.

Bingley.—BULK SUPPLY AGREEMENT TO END.—The Lighting Committee proposes to terminate as from March 31st, 1934, the existing agreement with Keighley Corporation in respect of the bulk supply of electricity from the latter, with a view to the arrangement of fresh terms more satisfactory to Bingley.

Birkenhead.—LOANS.—The Electricity Committee is applying for permission to borrow £20,000 for mains, £15,000 for wiring installations under the assisted wiring scheme and £1,500 for expenditure on electric irons installed under the scheme.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The High Commissioner for Canada in London has received from the Minister of the Interior at Ottawa his annual statement on hydro-electric activities in the Dominion, showing that water wheels and turbines actually installed and brought into operation last year resulted in the net addition of 578,923 h.p., bringing Canada's total to 7,045,260 h.p. Construction is being continued upon several large undertakings, which will add further to this total in 1933 and subsequent years. The programme of water-power construction now approaching completion was originated some three or four years ago, prior to the current trade depression. Down to the end of 1929 the production of electrical energy in Canada kept pace with the increase in installed capacity. Subsequently, however, depressed industrial conditions have resulted in a falling-off in demand, which reached its greatest intensity in the middle of 1931. More stable conditions, however, appear now to have been established, and during the months of August, September, and October, 1932, an increase was recorded in the volume of electrical energy produced for use in Canada, as compared with the corresponding period of 1931. The decrease in production last year is almost all accounted for by the loss of production for export. The increased installation recorded for 1932 is accounted for chiefly by the coming into operation of the Beauharnois development in Quebec, the Chats Falls plant on the Ottawa River, and the Corra Linn development on the Kootenay River in British Columbia, details of which are given in the Minister's statement. The Province of Quebec last year recorded a total increase in hydro-electric capacity amounting to 256,990 h.p., accounted for principally by the Beauharnois and Chats Falls developments, though progress was also made at other sites.

Cardiff.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £2,620.

LINKING-UP SCHEME.—The Committee is to discuss the possibility of arranging for a "mutual aid" scheme with the South Wales Power Co.

CONNECTION WITH THE GRID.—A letter has been received by the Committee to the effect that the Central Electricity Board anticipates that the connection to the Corporation generating station will be completed by next autumn, and that such supplies as may be required by the Corporation to supplement the output of its generating station will then be available.

Carlisle.—LOAN SANCTIONED.—The Electricity Committee has received sanction to borrow £2,000 required in connection with a supply of electricity to Gilsland.

Clacton-on-Sea.—LOANS.—The Urban District Council has applied for sanction to a loan of £1,436 for the provision of a kiosk with switchgear, transformer, etc., in the Pathfield Road district, and for £3,183 for kiosks, transformers, etc., in the Kings Avenue area, Holland-on-Sea.

Clitheroe.—ELECTRICITY FOR FARMERS.—In the hope of a revival in agricultural and village industries, the Electricity Department has embarked on a scheme on which £30,000 will be spent in the distribution of electricity in the rural area surrounding the town.

Colchester.—FACTORY SUPPLY.—The Electricity Committee has approved terms for supply to the Anglo-Italian Silk Importing Co., and has instructed the engineer to install on the company's premises a 6,600-V 50-kVA transformer, with the requisite switchgear.

TRANSFORMER KIOSK.—The Committee is to provide a transformer kiosk at a cost of £200 in Turner Road in connection with the supply to the premises now in course of erection at the Royal Eastern Counties Institution.

SUPPLY TO HOUSING ESTATE.—The Electricity Committee is to extend mains at a cost of £715 to supply the Ipswich Road housing estate.

LOAN SANCTION OBTAINED.—The City Council has received sanction to a loan of £11,395 for switchgear. Subject to the consent of the Ministry of Transport to the use of overhead lines, l.p. distribution extensions are to be carried out at Tollesbury, Eight Ash Green, Layer-de-la-Haye, and to the housing estates on the Ipswich and Harwich road.

Dartford.—REDUCED CHARGES.—The Electricity Committee has recommended that the tariff for outside shop lighting be reduced from 4½d. to 2d. per kWh.

Derby.—ASSISTING WIRING SCHEME PROGRESS.—Under the assisted wiring scheme 7,000 consumers have been connected up and others are being connected at the rate of 100 per week. Immersion heaters are being installed in bath tanks, and the growth of business has necessitated the opening of a department to deal with water-heating matters.

Doncaster.—TARIFF CHANGES.—The Electricity Committee has recommended the adoption of a l.p. bulk supply tariff of £5 per annum per kW of maximum demand, plus ½d. per kWh, conditionally upon the consumer having in regular use not less than 20 kW of other than lighting load.

Dumfries.—SUPPLY TO LOCKERBIE.—It is expected that a supply to Lockerbie and Annan will be available before the end of this month. The total number of applications in the county for electricity was 1,215.

Dunoon.—ELECTRICITY FOR INNELLAN.—A start is to be made next month with cable-laying for the extension of the electricity supply to Innellan.

East Ham.—E.H.P. MAINS.—The Electricity Committee has approved the estimate of £2,041, submitted by the electrical engineer, for installing e.h.p. mains for the purpose of affording a supply of electricity to a factory at Greatfield.

MINIMUM CHARGE ALTERATION.—The Electricity Committee has had under consideration the question of the minimum charge of 5s. per quarter for the supply of electricity to consumers on the ordinary lighting rate and now recommends altering it to one of 20s. per annum in future.

East Kent.—ELECTRICITY SUPPLY.—The Tenterden Rural District Council has been informed by Major C. B. Grace, managing engineer of the Weald Electricity Supply Co., Ltd., that one of the company's engineers is preparing a scheme for the supply of electricity to High Halden, Woodchurch, Appledore, Stone, Wittersham, and Rolvenden.

Friern Barnet.—A REQUEST FOR ELECTRICITY SUPPLY.—The Corporation Housing Committee has received a petition from 208 tenants and tenant purchasers on the Council housing estate, requesting the installation of electricity in their houses, and has referred the matter to the North Metropolitan Electric Power Supply Co.

Harrogate.—INQUIRY RESULT.—Notwithstanding opposition by Lord Mowbray and Stourton, the Minister of Transport has authorised the Corporation to carry cables over part of Allerton Park, Knaresborough, in connection with its scheme for supplying electricity to rural districts. The Minister's decision follows a recent inquiry.

Hastings.—SUPPLY TO HOUSING ESTATE.—The Electricity Committee is to extend mains to supply houses on the Eversley Road estate at an estimate cost of £1,010.

STREET LIGHTING IMPROVEMENTS.—Improvements to the lighting in various streets are to be made at an estimated cost of £516.

LOAN.—Application is being made for sanction to borrow an additional £15,000 for services.

Heston and Isleworth.—MAINS EXTENSIONS.—The Corporation has sanctioned specified mains extensions at a cost of £8,357.

Hove.—NEW SUB-STATION.—The Electricity Committee has recommended that application be made to the Electricity Commissioners for sanction to a scheme for the erection and equipment of a sub-station in Saxon Road. The cost is estimated at £5,590. The sub-station would relieve the existing sub-station, in addition to enabling a bulk supply to be taken from the Brighton Corporation's Southwick power station.

Hurst Green (Lancs).—INAUGURATION OF SUPPLY.—A supply of electricity was switched on by the rector of Stonyhurst College on January 12th.

Hutton Henry.—STREET LIGHTING.—The Parish Council has entered into a new agreement with the Wingate Grange Colliery Co. for public lighting by electricity for a period of five years, with seventy-four 60-W lamps at £2 5s. each per annum, plus 5s. 6d. each for renewals and repairs.

Isle of Man.—ELECTRICITY BOARD'S SCHEME.—Immediate steps are being taken by the Electricity Board to erect five 33-kV overhead transmission lines as follows:—(1) Douglas to Ramsey; (2) Douglas to Peel; (3) Douglas to Port Erin; (4) Ramsey to Peel; (5) St. Johns to Arbory. The Board was due to reach a decision last Saturday on the tenders that have been submitted for the works and also for the transformers. It will take its electrical energy from the Pulrose power station, Douglas, and it is expected that the scheme will be completed by July.

Lanchester (Co. Durham).—ELECTRICITY CHARGES.—The Rural District Council has agreed to make inquiries with a view to securing an all-round reduction in electricity charges. This follows a communication from the North-Eastern Electric Supply Co., Ltd., stating that the charge for the village of Muggleswick had been reduced from 7d. to 5d. per kWh. Charges for several other villages in the vicinity have not been changed.

Lincoln.—LOAN APPLICATION.—The City Council has applied for sanction to a loan of £14,184 for cable extensions, £5,000 for meters, and £7,000 for services.

London.—EALING.—The Electricity Supply Committee reports that owing to the exceptional increase in the demand for electricity in the areas concerned the new three-phase 33,000 to 400/230 V sub-stations at Brownlow Road and Sandringham Mews are working under full load conditions, and that the Dean Gardens sub-station at times each evening reaches overload conditions. As a consequence it has been decided to invite tenders for the installation of transformers and switchgear in each of these stations.

RING MAIN FEEDERS.—The Committee also reports that work in connection with the laying of the first of the eight 0.15 sq. in three-core 11,000-V three-phase ring main feeders, which will ultimately be carried out under the change-over scheme already approved, has been practically completed. It has been agreed to make arrangements for completely equipping the twelve sub-stations along the line of the main by inviting tenders for the installation of the necessary transformers, switchgear and voltage regulators.

The Committee has decided to fix the charge for electricity supplied to tubular systems of heating where no thermostat is fitted, at 1d. per kWh instead of 1½d. per kWh.

FULHAM LOAN.—The Borough Council is to apply for sanction to borrow £10,000 for mains extensions, and £10,000 for the purchase of new meters.

STOKE NEWINGTON.—The Electricity Committee recommends that £2,000 be authorised for cooker and wash-boiler installations, &c., as the £8,000 expenditure at present authorised will be practically exhausted by the end of February. It is also recommended that a new cable be laid in Lordship Terrace at a cost of £90.

Luton.—EXTENSION OF ELECTRICITY SUPPLY.—The Rural District Council has decided to raise no objection to the extension by the Corporation of the electricity supply in the parish of Barton, and Council houses at Barton, Streatley, and Sharpenhoe are to be wired for electric lighting.

Mitton (Lancs).—SUPPLY INAUGURATION.—The extension of the Clitheroe Corporation's supply to Mitton was connected up on January 11th.

Moffat.—ELECTRICITY RECOMMENDED.—The Lighting Committee has agreed to recommend to the Town Council that electricity should be introduced and that it be used for street lighting, corporation buildings, &c.

Newcastle-on-Tyne.—A REQUEST FOR ELECTRICITY.—Tenants of the Corporation housing estate in the Scotswood area have petitioned the Housing Committee to install electricity in all new houses constructed in the area, and tenants' associations of other estates have also expressed the opinion that electric lighting should be provided, while the Housing Committee is constantly receiving applications for permission to introduce electricity into dwellings equipped only with gas. A special sub-committee has been appointed to inquire into the case.

Newton-in-Makerfield.—ELECTRIC WELL PUMPS.—The Urban District Council has prepared a scheme for the installation of electric well pumps in place of old steam driven pumps at the water works, at a cost of £2,720.

Paisley.—ELECTRICITY CHARGES.—It was reported at a meeting of the Town Council on January 10th that a slight reduction would be made in the cost of the supply of electricity to small power consumers up to 100,000 kWh per annum. The Council also approved a recommendation by the Electricity Committee for an alternative domestic service tariff whereby a fixed annual charge would be made according to the size of the house, with the addition of a running charge for all electricity used of ¼d. per kWh.

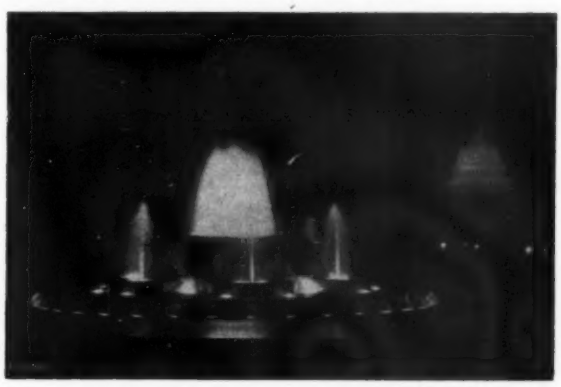
Plymouth.—HIRE PURCHASE SCHEME.—A report has been submitted by the engineer with regard to the charges payable under the scheme for the sale of fittings where the consumer desires to repay the balance of the cost of such installation, and the Committee has decided to amend the scheme so as to provide that the consumer may repay the balance outstanding of the cost of the installation on any quarter day on the basis of the cost plus 10 per cent. expenses, less an allowance of 5 per cent. per annum for each complete year.

Portsmouth.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £2,250 in roads where electricity is not at present available.

Richmond (Yorks).—METER RENTS REDUCED.—The Electricity Committee has reported that from April 1st next the minimum charge in respect of installations would be 30s. per annum for a single meter, and 20s. for each additional meter. The present charge is £2.

LOAN.—The Town Council is to apply for sanction to borrow £8,000 to cover the amount overspent on the capital account and to meet estimated expenditure on mains and services in the near future.

Tynemouth.—YEAR'S WORKING.—Mr. C. Turnbull, the borough electrical engineer, states that despite the fact that the trams ceased running, causing a loss of 189,000 kWh, the output of the Corporation's system increased by 81,000 kWh. The year's profit was £8,095, and of this sum £2,072 was contributed to rate relief and £2,632 was carried forward.



A beautifully illuminated fountain at Washington, D.C., with the floodlighted Capitol on the right

Wallsend-on-Tyne.—CABLE EXTENSIONS.—The Town Council has approved plans submitted by the North-Eastern Electric Supply Co., Ltd., for l.p. distribution cables to be laid underground in streets on the housing site adjoining the Bewicke School.

Woburn.—STREET LIGHTING.—The Parish Council has decided to adopt electricity for public lighting at £1 8s. per 60-W lamp per annum, and £2 2s. 1d. per 100-W lamp. The existing gas standards will be converted at a cost of £8 each, and a supply of electricity will be given by the Luton Corporation.

Woodhall Spa (Lincs).—CABLES PLACED UNDERGROUND.—The Mid-Lincolnshire Electricity Co. has agreed to substitute underground for overhead cables in certain parts of Woodhall Spa.

Traction

Belgium.—RAILWAY ELECTRIFICATION.—It is reported from Brussels that the directors of the Belgian National Railways Co. decided on January 12th to undertake the electrification of the lines between Brussels and Antwerp. The work will be completed at the beginning of 1935, and the estimated cost will be about 200 million Belgian francs. The conversion will result in an economy of 6 per cent. as compared with steam locomotion.

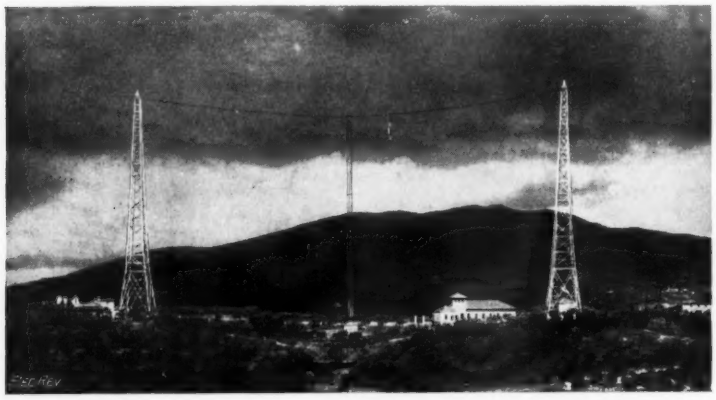
Brazil.—RAILWAY ELECTRIFICATION TENDERS.—It is reported from Rio de Janeiro that the commission appointed to consider the schemes submitted for the electrification of the Central Brazilian Railway has reached the conclusion that the documents submitted by the various competitors are incomplete. As a consequence the Minister of Public Works has decided that fresh invitations shall be issued to native and foreign competitors.

Great Western Railway.—STEAM LOCOMOTIVE SHOES FOUL ELECTRIC RAIL.—The shoes carried by the Great Western locomotives that are equipped for automatic train control are liable to foul the rails conveying the traction current on those lines in the London area that are equipped for electric traction, and it has been found necessary to devise a scheme for clipping up the shoes on locomotives working to the electrified lines and for resetting the shoes on returning from those lines.—*The Engineer.*

London.—A SEVENTIETH ANNIVERSARY.—On January 10th the Metropolitan Railway celebrated its seventieth birthday, the Paddington and Farringdon Street section having been opened on that day in 1863. Electric working on the Inner Circle section began on September 12th, 1905.

Norwich.—RESULT OF THE POLL.—According to *The Times*, a municipal poll was held on January 10th at Norwich to decide whether the city should purchase the Norwich Tramways Co.'s undertaking. The result was announced the same evening as follows: For the purchase, 7,775; against, 11,033—majority against, 3,258. There are nearly 63,000 persons qualified to vote. By a majority of two to one the City Council recommended the purchase of the tramways. The grounds of the opposition which has necessitated the poll are that the recommended price of £175,000 is excessive, or, in the alternative, that it covers only a part of the commitments in which the City would be involved by the ownership of the tramways. The proposed purchase is supported by leading members of all three parties on the Council.

Sweden.—RAILWAY ELECTRIFICATION.—Among the numerous and extensive public works provided for in the Swedish Budget, those connected with the electrification of the State Railways are the most important, states *Reuter's Trade Service* from Stockholm. For the continuation of work on the electrification of the Stockholm-Malmoe-Traelleborg main line with junction lines an allowance of Kr.9,000,000 is proposed for the next financial year. As expected, the Government proposes that the electrification of the northern main line Stockholm-Krylbo-Aange, with the Oerebro-Krylbo line, be commenced, an allowance of Kr.19,000,000 for next year being requested. The total cost is estimated at Kr.49,500,000. According to the plan drawn up by the Railway Board, the work will be completed in April, 1936, if begun not later than May 1, 1933, the Oerebro-Krylbo line being completed in October, 1934, and the Stockholm-Upsala line in April, 1935. The Government also proposes that the electrification of the so-called West Coast line between Malmoe and Gothenburg with the connecting Haelsingborg-Aengelhohn line shall begin at once, and an allowance of Kr.11,000,000 for this purpose is requested. The complete plan for this electrification has not yet been published. For the continued construction of the Inland Railway, which will unite Central Sweden with the northernmost part of the country by a line running parallel to the existing main line, the usual annual allowance of Kr.4,000,000 is proposed. It is estimated that the line will be completed in 1937 or 1938.



A general view of the Florence station of the Italian Broadcasting Company. The masts are 300 ft. high and the station has a 20-kW Marconi transmitter

Communications

Corsica.—TELEPHONY.—The Postmaster-General announces that telephone service is now available between all parts of Great Britain and all parts of Corsica, communication being by wire to Nice and thence by a radio link to the island.

Great Britain.—RADIO LICENCES.—The Post Office issued 5,262,953 wireless licences last year, of which 140,000 were taken out in December. In November 381 persons were prosecuted for operating wireless sets without licences, and in every case a conviction was secured. Out of this number thirty-eight were in London and forty-three in Manchester.

RADIO RELAY EXCHANGES.—The Truro Corporation Improvements Committee is to consider a proposal of G. Lawrance and Co., Ltd., for the establishment of a radio relay exchange.

The Gloucester City Council has declined to consider an application from the South West Electricity, Ltd., for permission to establish a service, as its Highways Committee has deferred *sine die* a similar application from a local company.

The Motherwell Town Council has decided to raise no objection to the establishment of a service by Rediffusion, Ltd.

The Highways Committee of the Huddersfield Town Council has again received an application by Broadcast Listeners' Service, Ltd., for permission to establish a service in the borough. The company offers the Corporation a guaranteed minimum of £5,000 for a ten years' licence, with an immediate payment of £1,000, and to form a local company operated on public utility lines.

Galashiels Town Council has granted permission to Mr. Bryan Groom to operate a service throughout the burgh, which, it is stated, will be the first service of the kind in Scotland.

The Wolverhampton Corporation has made an agreement with Rediffusion, Ltd., granting a general right to make attachments to Corporation properties.

POLICE TELEPRINTERS.—The more important police stations in the Metropolitan area are being equipped with P.O. exchange teleprinter instruments, and the service is likely to be extended to police headquarters throughout the country.

India.—NEW RADIO SERVICE.—The Indian Communication Co. inaugurated a direct radio beam service between Bombay and Japan on January 11th.—*Reuter* (Bombay).

Irish Free State.—ATHLONE STATION TESTS.—Test programmes from the new Irish Free State broadcasting station at Athlone, which is equipped with a Marconi 60-kW transmitter, have been widely received abroad, including Newfoundland, India, Iceland, Greenland, and, in addition, practically throughout Europe. The wavelength of the Athlone station is 413 metres, which is that of the existing Dublin station.

London.—G.W.R. CARRIER TELEPHONY.—The carrier telephone apparatus installed by the Great Western Railway Co. in 1931 between Reading and Swindon has proved highly satisfactory. A slight rearrangement of circuits made last year provided an additional trunk line between Reading and Paddington; and at the same time the carrier apparatus was transferred to Paddington, working between there and Swindon. Experience has shown that the greater the distance over which the apparatus is operated the greater is the saving from an economic point of view. A further extension has been made between Swindon and Bristol. Creed high-speed direct-printing telegraph apparatus was installed during the past year between Newport, Cardiff (General), and Cardiff (Queen Street). The instruments are usually set to work at a speed of sixty words per minute, and in practice a skilful operator can transmit for long periods at a speed of from fifty to sixty words per minute.

The New Wychbold Transmitter

THE British Broadcasting Corporation has placed an order with Marconi's Wireless Telegraph Co., Ltd., for a high-power transmitter to be installed in the new Wychbold, Droitwich, station which is to take the place of the Daventry long-wave station. The plant will incorporate a new system of "series modulation" and high-power valves capable of dealing with very large inputs. The power rating will be 100 kW unmodulated carrier energy, with modulation up to 90 per cent., and the frequency characteristic will be straight between 30 and 10,000 cycles.

New Series Modulation

The application of series modulation has made it possible to effect a very considerable simplification in design. The transmitter will consist of a drive with only two power stages, the first of which will be modulated, while the main oscillatory circuit will complete the transmitting equipment. The modulator and the modulated power stage are to be placed in series across a constant voltage supply. The resistance of the modulator will be so adjusted by means of grid potential that the total voltage will be divided between the two units. The modulated amplifier can be considered as a constant resistance, whereas the modulator represents a resistance variable by the variation of its grid potential. Therefore, a change in the modulator resistance will cause the voltage across the modulated amplifier to vary in a manner directly proportional to the variations in the grid circuit of the modulator, which receives its input from the microphone speech amplifier. By this means the stages of modulated amplification required can be reduced to one only, with a consequent reduction in harmonic distortion inevitably produced and multiplied by each stage of this class of amplification.

Transmitter Design

The transmitter will consist of five aluminium units, with glass doors, placed in line, and with a control desk. The modulator is to be fitted with four Marconi water-cooled valves of the C.A.M.3 type, operating with an input of 50 kW, and the modulated amplifier with four type C.A.T.6 valves, also water-cooled. The output of this stage is to be 20 kW, at an efficiency of 65 per cent., delivered direct into the final power stage. The anode voltage applied to the modulator and modulated amplifier in series will be from 18,000 to 20,000 V. Each final power stage will contain three water-cooled valves of the C.A.T.14 type, operating at 18,000 to 20,000 V on the anodes, a total of six valves being installed. One valve in each unit will be a spare.

The C.A.T.14 illustrated on p. 88 is one of the latest high-power transmitting valves. On telegraph loads it can be worked with an input of 500 kW, and is capable of withstanding a continuous anode dissipation of 150 kW. On telephony with an input of 150 kW, at an efficiency of 33⅓ per cent., the valve is capable of delivering an unmodulated carrier energy of 50 kW. Further details of these new valves were given in our January 6th issue (p. 18).

Each valve will have its own lighting dynamo with a field regulator, thus permitting independent and accurate adjustment of the required filament voltages.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Australia.—MELBOURNE.—February 13th. Victorian Electricity Commission. Automatic voltage-regulating equipment. (A.X. 11655.)*

Barnes.—February 6th. Corporation. Traffic control signals. (January 6th.)

Blackburn.—February 27th. Electricity Department. Cable, rubber insulated wire, and meters. (See this issue.)

Cardiff.—February 3rd. Public Health Department. 1,800 electric lighting fittings for Llandough Hospital. (January 13th.)

February 6th. Public Health Department. Staff signalling system at Llandough Hospital. (January 13th.)

China.—Government Purchasing Commission. Structural steel angles and plates, galvanised iron and copper wire, telegraph instruments, &c. (See this issue.)

Eastbourne.—Electricity Department. January 23rd. H.p. and l.p. cables. (January 13th.)

Edinburgh.—January 23rd. Corporation. Installation of electric lighting and power in the west wing, City Chambers. Specifications, &c., from the Engineer's Office, Dewar Place (deposit £1 1s.); tenders to Town Clerk.

Egypt.—CAIRO.—February 7th. Ministry of the Interior. Power station of about 660-kVA capacity. (A.X. 11599.)*

March 22nd. Lighting installation on the new bridge at Minia. (A.X. 11665.)*

Elie and Earlsferry (Fife).—January 23rd. Corporation. Various works (including electrical) at housing scheme. Mr. A. D. Haxton, architect, Commercial Road, Leven.

Hastings.—February 7th. Electricity Department. Materials for twelve months. (See this issue.)

Isle of Man.—January 23rd. Electricity Board. 33-kV transformers. (January 6th.)

Liverpool.—February 1st. Electricity Department. General stores. (January 6th.)

London.—STOKE NEWINGTON.—February 13th. Electricity Department. House service meters and l.p. cables. (See this issue.)

Markinch.—January 25th. Town Council. Various works (including electrical) at twenty houses. Schedules from Mr. A. D. Haxton, architect, Leven; tenders to Town Clerk.

New Zealand.—WELLINGTON.—February 15th. Post and Telegraph Department. Cord adjusters for telephone switchboards. (A. 11650.)*

March 1st. 46,000 terminal and lead-in insulators. (A.X. 11653.)*

March 7th. Public Works Department. 21,300 yds. of v.i.r. cables for Waitaki. (A.X. 11651.)*

DUNEDIN.—March 10th. Corporation. Centrifugal pump, motor, and accessories. (G.X. 12177.)*

Northern Ireland.—BELFAST.—January 27th. Electricity Department. General stores. (January 6th.)

Plymouth.—Electricity Department. February 6th. Meters, time switches, cables, transformers, and switchgear. (January 13th.)

South Africa.—JOHANNESBURG.—January 28th. City Council. Metal-clad l.p. switchgear. (A.X. 11647.)*

February 10th. Government Supplies Board. Lead-covered cable, switchboard cable, flame-proof wire, v.i.r. wire, and 50,000 copper suspension rings. (A.X. 11662.)*

PORT ELIZABETH.—January 26th. City Council. Cables, transformers, motors, and switchgear. (A.X. 11646.)*

MOSUL BAY.—February 15th. Municipal Council. Generating plant, including water-tube boiler, alternator sets, switchboard panels, 100-kVA transformers and distribution material. (A.X. 11664.)*

Southend-on-Sea.—February 9th. General stores for twelve months. (January 13th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Bootle.—Health Committee. Accepted. Electrical work, Linacre Hospital extension (£242).—McGoff & Vickers.

Chesterfield.—Transport Committee. Accepted. Renewal of overhead trolley route lines (£1,973).—Estler Bros.

Dartford.—Electricity Committee. Recommended. Wiring for cooker hire-purchase scheme for six months, 11s. 9d. for a minimum supply of three yards, and 1s. 9d. for each additional yard.—Dartford Electrical Co.

East Ham.—Works Committee. Accepted. Fifty tons of tramway rails.—Dorman, Long & Co., Ltd.

Hastings.—Electricity Committee. Accepted. 200-kVA transformer for Rye Harbour supply (£309).—Ferranti, Ltd. Transformer kiosk, Rye Harbour (£227).—Standard Switchgear Co., Ltd.

London.—STOKE NEWINGTON.—Electricity Committee. Recommended. Underground cables (£639).—W. T. Henley's Telegraph Works Co., Ltd.

Montrose.—Royal Asylum Board. Accepted. Cable from the main building to the nurses' home.—G. Smith.

Morecambe.—L.M.S. Railway Co. Accepted. Electrical work at the new Midland Hotel.—A. R. Farrar & Co.

Newcastle-upon-Tyne.—Town Council. Accepted. Installation of electric lighting in the Fulwell senior girls' and junior mixed council schools and the Redby council schools.—Reid, Ferens & Co., Ltd.

New Malden.—U.D.C. Accepted. Installation of the Moore and Knight system of alarms and call-bells (£1,035).—Walter's Electrical Manufacturing Co., Ltd.

South Shields.—Housing Committee. Accepted. Electrical installation at Green Lane houses (£176), B. L. Oliver; and at West Park houses (£107), F. Goodall & Son.

Forthcoming Events

British Electrical Development Association.—Friday, January 20th. Caxton Hall, S.W. 7.30 p.m. "Selling Demonstrations." Mr. W. Attwood. (*Northern Counties Area.*)—Wednesday, January 25th. Sopwith's Lounge, Newcastle-on-Tyne. 7.15 p.m. "Air Conditioning Plant." Mr. K. M. McKenzie.

Association of Mining Electrical Engineers.—Saturday, January 21st. South Wales Institute of Engineers, Cardiff. 6 p.m. "Application of Safety Devices in Winding." Mr. R. Metcalfe.

Institution of Electrical Engineers.—Monday, January 23rd. Institution, London. 7 p.m. Informal meeting. Discussion on "The Use of Electricity in Agriculture." Opened by Mr. F. E. Rowland. (*West Wales (Swansea) Sub-Centre.*)—Friday, January 20th. Hotel Metropole, Swansea. 7.30 p.m. Annual dinner and dance. (*Mersey and North Wales (Liverpool) Centre.*)—Monday, January 23rd. University, Liverpool. 7 p.m. "The Relative Fuel Economy of Electricity, Gas, Oil, and Solid Fuel as Heating Agents." Mr. A. H. Barker. (*North-Eastern Centre.*)—Monday, January 23rd. Armstrong College, Newcastle-upon-Tyne. 7 p.m. "The Bypath Automatic Telephone System." Messrs. J. H. E. Baker and E. P. G. Wright. (*London Students' Section.*)—Monday, January 23rd. Institution of Mechanical Engineers, London. Joint meeting with the London Graduates' Section of the I.M.E. "Steam-Raising Plant and the Modern Central Power Station." Mr. C. H. Russell. Wednesday, January 25th. 6 p.m. Visit to Broadcasting House, W. (*Scottish Centre.*)—Tuesday, January 24th. North British Station Hotel, Edinburgh. 7 p.m. Papers by Messrs. J. Sorbie & W. McE. Buchanan. (*North Midland Centre.*)—Tuesday, January 24th. Hotel Metropole, Leeds. 7 p.m. "Electricity in Mines." Mr. A. R. Cooper. (*North-Western Students' Section.*)—Tuesday, January 24th. Engineers' Club, Manchester. 7.15 p.m. "Some Railway Electrifications in the U.S.A." Mr. R. B. Adams. (*North-Western Centre.*)—Friday, January 27th. Engineers' Club, Manchester. 7.15 p.m. Joint meeting with Manchester Association of Engineers. "Progress in Electrical Motor Development." Mr. D. B. Hoseason. (*North-Eastern Students' Section.*)—Friday, January 27th. Armstrong College, Newcastle-upon-Tyne. 7.15 p.m. Students' lecture. "Oil-filled Cables." Mr. R. E. G. Horley.

Electrical Power Engineers' Association.—(*London Technical Group.*)—Tuesday, January 24th. Junior Institution of Engineers, London. 7.15 p.m. "Condenser Troubles—Erosion and Corrosion." Dr. E. Bowden.

Birmingham Electric Club.—Friday, January 27th. Grand Hotel, Birmingham. 7 p.m. Presidential address.

Royal Society of Arts.—Friday, January 27th. Adelphi, W.C. 4.30 p.m. "Railway Electrification in India." Mr. F. Lydall.

Our Service Department

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of the makers of the following:—

VOLTALAC insulating varnish.
DURALIFE accumulator.
EMITTA accumulator.
Small electrolytic rectifiers.

Photo-electrically Controlled Gas Furnaces

MESSRS. THOS. HEDLEY & CO., LTD., have installed photo-electric equipment in their Newcastle works to shut off automatically the main gas supply whenever the flame of the burners becomes extinguished, thus considerably lessening the likelihood of explosions through the accumulation of unburnt gas. The main gas valve is controlled by a pilot valve, the normal function of which is to admit gas to the underside of a diaphragm, which keeps the main gas valve open. The solenoid of the pilot valve is excited during normal working, the current being fed through a contactor which in turn is controlled by the relay in the photo-cell amplifier. The photo cell is arranged to view the gas flame, and immediately the latter is extinguished the relay operates and releases the contactor. The pilot valve then connects the underside of the gas valve diaphragm to an exhaust pipe. Atmospheric pressure on the top of the diaphragm, assisted by a spring, closes the main valve and shuts off the supply of gas. At the same time the induced-draught fan motor is shut down, and, as the supply to the photo-cell apparatus is taken from the fan motor through a transformer, any failure will also cause the main gas supply to be shut off. The photo-electric equipment was supplied by the General Electric Co., Ltd., and the special pilot valve by the Drayton Regulator and Instrument Co.

Notes

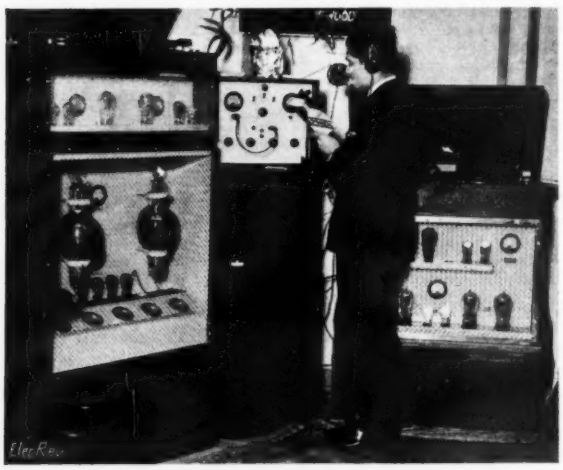
Scottish Explosion Inquiry

Sir Henry Walker, Chief Inspector of Mines, presided at an inquiry at Glasgow into the recent disaster at Cardowan Pit, Stepps, Lanarkshire, when eleven men lost their lives. Mr. Stoker, of the Mines Department, Board of Trade, was present in the absence through illness of Mr. John Masterton, H.M. Chief Inspector of Mines for Scotland. Conflicting evidence was given on two important points: (1) Whether the shaft was tested for gas before the shots were fired, and (2) whether stone dust was used by the shot firers in accordance with the regulations. Mr. C. B. Platt, superintending testing officer of the Mines Department, said that a number of lamps, an exploder, and firing cable were sent to him for examination. The shot-firing cable was more or less dilapidated, and two of the twelve cap lamps were not fitted with fuses. He did not find sufficient damage in the cables, however, to suspect the lamps in this instance. He had also tested a length of cable and a dynamo exploder used in the mine for firing shots to see if it was of sufficient strength to cause a spark. The test was made in fire damp, and he ignited it. He agreed that he had to deliberately put them into contact and then break the contact, and that if there was no such contact there would be no risk of fire.

In reply to Mr. Graham Robertson, K.C., for the pit owners, Mr. Platt said that a spark occurring at the switch contact of the electrical apparatus would ignite fire damp, but the flame would not pass out to the gas surrounding the cable. An explosives expert, who inspected the scene of the explosion, said that judging by some lengths of denotator wire he found in the pit he formed the opinion that there had been multiple firing of charges, and added that the shots had been fired together at a distance of four or five feet apart.

Amplification at Olympia

Our illustration shows some equipment of Tannoy Products which is in use for the circus at Olympia. The main apparatus consists of three power rectifiers, one with an output stage of ½ kW, the others ¼ kW each. Each of these is wired to a three-stage microphone amplifier connected to microphones in the bandstand for relaying the circus band; in the ring entrance for the ringmaster's announcements; and a local microphone on the stand to give record titles, other announcements, &c. There is a three-valve amplifier with correction circuit for microphone, and special input and output transformers to match 500-ohm microphones and transmission lines.



Amplifying apparatus at Olympia

A feature of this amplifier is an ingenious arrangement for "mixing" four microphones without mutual interference. The ¼-kW amplifiers are stand-by instruments. The outputs of the amplifiers are matched to 15 ohms, which allows the outputs to be paralleled for increased volume. Large moving-coil speakers are placed around the circus arena, and throughout the "Fun Fair"; they are capable of handling an undistorted signal of 20/25 W. The field supply is 50 W per speaker.

An E.P.E.A. Dance

The Manchester Section of the Electrical Power Engineers' Association held a social and dance at the Grand Hotel, Piccadilly, Manchester, on January 14th. Mr. S. A. Russell, chairman of the Section, made a short speech, in which he thanked Mr. F. Killeen, the organising secretary, and Mr. and Mrs. F. E. Larcombe. Mrs. Larcombe presented the whist and spot dance prizes, after which refreshments were served

Forthcoming Dinners

The Association of Supervising Electrical Engineers is holding its annual dinner and reunion on February 18th at the Trocadero Restaurant, Piccadilly, W.1, at 6.30 for 7 p.m.

The annual dinner of the Diesel Engine Users' Association will be held on February 7th at the Coventry Restaurant, Wardour Street, W., at 7 for 7.30 p.m. The chair will be taken by the president, Mr. C. F. Mounsdon, M.I.E.E.

The annual dinner of the Finsbury Technical College Old Students' Association will be held at the Trocadero Restaurant, Piccadilly, W., on March 18th.

The I.E.E. (North-Western Centre) Dinner

The annual dinner of the North-Western Centre of the Institution of Electrical Engineers was held on Tuesday at the Midland Hotel, Manchester, about 260 members and guests attending. Mr. G. G. L. Preece, the vice-chairman of the Centre, presided in the absence of Mr. G. F. Sills (chairman) on account of influenza. Other influenza victims included Mr. G. H. Nelson, Professor Bragg, Mr. A. C. Livesey, chairman of the Liverpool Centre, and Mr. J. M. Gillespie, chairman N.W. Students' Section.

Sir Holberry Mensforth, proposing "The Cities and Trades of Manchester and Salford," said that Britain's future would not lie in competing with mass production by less advanced races, but on lines which engaged the best forms of craftsmanship. The Lord Mayor of Manchester (Alderman Walker) responding, referred to his twenty-nine years' connection with the Centre. He hoped that a grid tariff for the N.W. Midlands would soon be published. There were signs of revival in the industries of the area; he hoped that co-operation between capital and labour in the cotton industry would revive world trade in that field.

Mr. A. E. L. Chorlton, M.P., proposing the toast of the Institution, commended the electrical industry for its interest in research. The need for research and invention was stronger than ever. He did not favour cutting down public expenditure but advocated large public works to employ technical men in the early stages and workmen later; this would promote the confidence which was needed to revive trade.

Professor E. W. Marchant (president), responding, referred to the enormous sums spent on developing the roads during the past ten years or so and said that more should be done to make the railways useful. Even in Sweden, where conditions from the electrical standpoint were unsatisfactory, main-line electrification had paid. In Great Britain there were many suburban lines which should be electrified. Advantage should be taken of the present cheapness of money to ask the Minister of Transport to consider the giving of a Government guarantee for the loans required. There was no doubt whatever that such expenditure would prove remunerative, but the guarantee would enable the money to be raised at a lower rate of interest.

The chairman proposed "Our Guests" in happy terms and the Mayor of Bootle (Alderman James Scott) replied, saying that he was interested in three new undertakings whose first full year would end in March. These had load factors over 30 per cent. due mainly to the encouragement of the domestic business. He believed that it was impossible to develop with a charge of more than 1d. per kWh or without a hire (not hire-purchase) system. One of the three undertakings provided everything for all electric houses at an inclusive charge of 1d. per kWh.

Mr. H. C. Lamb (city electrical engineer, Manchester) proposed the chairman's health, and Mr. Preece replied.

Appointment Vacant

Electrician mechanic for Croydon Mental Hospital. (See our classified advertisements.)

The Electrical Association for Women

The new year programme of events arranged by the E.A.W. includes a visit to the Building Centre, London, on January 24th, when Mr. F. R. Yerbury, director of the Centre, will talk on "The Modern Trend in Building." On January 31st the official opening of the Association's new premises, 20, Regent Street, will take place. Miss Anna Holm will give a lecture-demonstration there on "Dinner for Four for the Cook-Hostess" on February 8th, while on March 1st she will give "Electrical Hints for Spring Cleaning," &c.

The annual ball with supper and cabaret is to be held at the Dorchester Hotel on March 17th, and the annual conference will take place in Birmingham from May 3rd to 5th.

The calling of a Yorkshire women's conference at Halifax, possibly in March, to discuss, among other things, the electrification of the countryside from the women's point of view, was suggested by Miss Haslett at a dinner held by the Halifax Branch of the E.A.W. on January 12th. The Association's training scheme was creating a possible career for girls and helping to provide trained women who would assist people to make the best possible use of the grid when it was completed. Some 150 diplomas in electrical housecraft had been already awarded, and applications were still coming in. Mr. A. C. Cramb, director of E.D.A., proposing the toast of the Halifax Branch of the E.A.W., said that sufficient attention had not been paid to the commercial side of electricity and to its distribution. Miss Cockroft responded.

Lectures on Illumination

In co-operation with the National Illumination Committee and the Illumination Engineering Society, the Polytechnic, Regent Street, London, has arranged for the delivery of a course of lectures on Wednesdays at 6 p.m. on various aspects of illumination, commencing on February 8th. They are to be delivered by experts in their respective subjects, and the course constitutes an interesting departure which it is hoped will become a regular feature in future. The fee for the course of ten lectures is one guinea, or 5s. per single lecture. Visits to the N.P.L., the G.E.C. laboratories, and the Home Office Industrial Museum are being arranged.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. K. G. Glover, B.Sc., A.M.I.E.E., who has recently taken up duty as protection gear engineer in the South West England and South Wales area of the Central Electricity Board, was previously with the Metropolitan-Vickers Electrical Co., Ltd., with whom he held the successive appointments of junior engineer, erection engineer and design engineer, his last position being in the Meter Engineering Department (relay section), where his work was connected with the design and application of protective and automatic gear and regulators.

Mr. W. T. Hilder, M.I.E.E., of Swindon, has been appointed engineer and transport manager to the Haslingden Corporation out of fifty-eight applicants for the position. Mr. Hilder, who is a native of Swindon, was educated at the Church School and at the College, Swindon, and after a four years' apprenticeship, and an improvership of about four years with the Swindon Corporation Electricity and Tramways Departments, was appointed shift engineer in the Electricity and Tramways Departments of the Aberdare Urban District Council, where he became successively mains superintendent, outside superintending engineer, and manager.

Mr. W. T. Hilder

After holding the position of engineer and manager at Aberdare for nearly six years he was appointed to a similar position by the South Somerset & District Electricity Co., Ltd., with whom he remained for about three years. His service with municipal undertakings covers a period of nearly twenty-five years. During the war he served with the London Electrical Engineers, R.E. (T.). Mr. Hilder was elected a member of the Institution of Electrical Engineers in 1924.

Mr. A. Lucas has retired from the position of Sheffield district engineer and manager for the British Thomson-Houston Co., Ltd., a position which he has held for the past thirty-three years. He is succeeded by **Mr. O. S. Nichols,** who has been manager of the Liverpool office of the company. Mr. Lucas has been associated with the industry for over half a century. He was a boy of 16 when he entered the industry at Barnsley, and at that early age he invented a colliery signal bell for winding engines which was exhibited at the Yorkshire Agricultural Show at Barnsley. In 1886 he joined the staff of Tasker Sons & Co., electrical engineers, of Sheffield (afterwards

Messrs. O. S. Nichols and A. Lucas, of the B.T.-H. Co.

the Sheffield Electric Light & Power Co., Ltd.), and when the concern was taken over by the Corporation he went with it as assistant manager. He took an active part in the introduction of electric lighting and telephone into Sheffield by Tasker's. He left the Corporation's service in 1899 to join the staff of the British Thomson-Houston Co., who had secured the contract for the electrical equipment of the Sheffield tramway service, which was being converted from horse traction. On his retirement Mr. Lucas has been presented with a clock by his office staff, and with a cigar case by the local construction staff. He is not leaving Sheffield, and he still intends to do occasional consulting work.

Mr. A. B. Race, manager of the company's Manchester district office, will take over the managership of the Liverpool office, and will be responsible for both these offices.

Dr. C. V. Drysdale, O.B.E., M.I.E.E., F.R.S.E., Director of Scientific Research at the Admiralty, has been appointed a member of the Safety in Mines Research Board. Mr. F. Edmond, chief mining agent to the Wigan Coal Corporation, Ltd., and Major H. M. Hudspeth, chief mining engineer to the board, have also been appointed members.

[Elliott & Fry

Dr. C. V. Drysdale

Mr. M. Feetham, chief constructional engineer of the London Power Co., who retired on December 31st last after forty-three years' service with the company and its predecessors, was presented with a silver salver, a tea and coffee service, and a diamond brooch for Mrs. Feetham, at the fifth annual staff dinner held at the Holborn Restaurant on January 13th, over which Mr. Pearman, general manager, presided. Dr. S. L. Pearce, who made the presentation, paid a tribute to the valuable services which Mr. Feetham had rendered to the electrical industry and to the companies which he had served, and Mr. Feetham, in replying, gave interesting details concerning the history of the Deptford power station, and referred to the difficulties experienced in the pioneering days of the industry.

Mr. E. R. Pearson, who has retired after 45 years' service with British Insulated Cables, Ltd., has received a presentation from the staff. The presentation was made by Mr. E. A. Bayles, manager of the Helsby factory.

Mr. C. T. Ashby, manager of the telephone service in the Norwich and Cambridge district, has retired after holding that position since 1916. Mr. Ashby served his apprenticeship with Messrs. Gent & Co., Leicester, and in 1892 he joined the staff of the National Telephone Co., for whom he became inspector at Coventry, and later local manager of the North Wales district. Until the Government took over the service in 1912 he was district manager at Canterbury.

Mr. J. P. Tucker, who has been appointed engineer to the Isle of Man Electricity Board, took up his duties on January 16th.

Mr. T. B. Conway, manager of the Welsbach Light Co., Ltd., Bristol depot for many years, has retired, and his place has been taken by **Mr. H. W. Haddow,** who has also been with the Welsbach Company for a considerable number of years.

Mr. C. D. Gibb, a director of Messrs. C. A. Parsons & Co., Ltd., has been elected chairman of the North-Eastern branch of the Institution of Mechanical Engineers.

Mr. H. S. Aspinall has resigned his position as the London director of Messrs. Petters, Ltd., and has joined the English Electric Co., Ltd., as manager of Diesel engine sales. From 1923 to 1928 Mr. Aspinall was director and general manager of Vickers - Petters, Ltd., Ipswich. For the present Mr. Aspinall's headquarters will be at the London office of the English Electric Co., Queen's House, Kingsway, W.C.2.

Mr. Gerald W. Partridge, M.Inst.C.E., has joined the board of the Charing Cross Electricity Supply Co., Ltd.

[Drummond Young

Professor Francis G. Baily, M.A., F.R.S.E., who is retiring shortly from the Chair of Electrical Engineering in the Heriot-Watt College, Edinburgh

Obituary

Mr. S. Lawton.—The death is announced at the age of 32 years of Mr. Stanley Lawton, of Dukinfield, manager of the Brunswick Street sub-station of the local Joint Electricity Board.

Mr. A. Beeney.—The death occurred on January 1st at the age of 53 years of Mr. Arthur Beeney, principal of the firm of Beeney Bros., electrical and agricultural engineers, Hailsham.

In the Courts

IN the Chancery Division on January 11th, Mr. Justice Luxmoore had before him an action, brought by Murex Welding Processes, Ltd., against Weldrics (1922), Ltd., the judge being asked to determine the preliminary issue as to the meaning and extent of an order dated March 19th, 1924, in the action Alloy Welding Processes, Ltd., *v.* Weldrics, Ltd., and Weldrics (1922), Ltd:, on the footing that the electrodes in question in the present action were alleged to be identical with those in the former action.

Mr. Mold, for the defendants, said that the question before the Court was the trial of an issue for the purpose of having it decided whether the plaintiffs could maintain the action in view of an order for discontinuance made in a former action between the same parties in 1922, although then the plaintiffs in the action were known as Alloy Welding Processes, Ltd. The plaintiffs were suing for the alleged infringement of letters patent granted to Ernest Henry Jones, which related to alleged improvements in electrodes for electric arc welding.

The plaintiffs in the former action gave an undertaking not to bring any further action in respect of the infringement of the letters patent complained of in that action, and on that undertaking they had leave to discontinue the action on payment of costs.

Mr. Mold had pleaded that the present alleged infringements were complained of in the former action and the only question now was whether the Master's order in the former action related solely to the precise acts of which particulars were given or whether they related to the type of infringements of which those acts were examples.

Mr. Justice Luxmoore, in giving judgment, said that in deciding the question which was before him he had to consider the actual words of the undertaking which had been given, and, in his opinion, the order of March, 1924, did not preclude the bringing by the plaintiffs of the present action. He made the costs of the issue the plaintiffs' costs in the action in any court.

A Mercury Cut-out Dispute

In the Chancery Division on January 13th, Mr. Justice Farwell concluded the hearing of an action brought by Mr. R. Bell against Mr. J. C. Harvey and his brother, Mr. A. Harvey, to recover damages for alleged breach of an agreement of February, 1931, to surrender to him certain British patents registered in the name of "Mercurial Cut-outs, Ltd."

Mr. A. Grant, K.C., for the plaintiffs, said it was not disputed that an agreement was entered into, but the parties differed as to its terms. The matter arose out of a certain invention called mercurial cut-outs, the object of which was to substitute mercury for the wire in fuse boxes. There were a number of British and foreign patents taken out by the plaintiff and a Mr. Illingworth. In September, 1928, an agreement was entered into with the defendants for the sale of the patents to them, and a company called "Mercurial Cut-outs, Ltd.," was formed to exploit the invention. The company acquired the British patents, and the foreign patents were held on a kind of joint basis. As consideration for the sale the company was to pay the vendors £60,000, of which £10,000 was to be in cash, and the balance in £1 shares in the company. Completion was on December 17th, 1928, when £5,000 cash was paid on account. A factory was erected at Biggleswade, Bedford, and the plaintiff was appointed engineer and technical adviser.

Matters, however, did not progress at all satisfactorily, and at the end of 1930 the defendants said they were not satisfied that the patents were a commercial proposition, and that they would not have anything more to do with them. Meanwhile the company had paid the plaintiff £3,370 out of the second £5,000. Negotiations took place which resulted in the agreement now in dispute. The plaintiff agreed to surrender his service agreement and that of his son in consideration of which he was to get back the patents. The dispute arose in connection with the 50,000 £1 shares allotted to the plaintiff. He undertook to surrender all of these which were controlled by him, and his case was that he agreed to use his best endeavours to obtain the surrender of those which he had parted with; he was unable to get them all back.

The case for the defendants was that the plaintiff undertook to obtain the surrender of all the shares, and this he had failed to do.

At the conclusion of the evidence his Lordship gave judgment for the defendants, holding that the plaintiff had not proved the alleged contract on which he sued. He accordingly dismissed the action as against both defendants, with costs.

Light from a Power Circuit: Appeal Dismissed

On January 13th a Divisional Court of King's Bench, consisting of the Lord Chief Justice and Justices Avory and Branson, heard an appeal by Mr. R. Denwood, of Whitehaven, from a decision of the local Justices who had fined him £3, including costs, on a summons issued by the Whitehaven Corporation, alleging that the appellant had unlawfully and fraudently consumed electric power.

Mr. Philip Vos, for the appellant, said the Justices had stated a case for the opinion of the Court. The action of the Corporation was taken under one of the sections of the Gas Works Clauses Act, which had been incorporated in the Electric Lighting Act, 1882. The question at issue was whether there was a *prima facie* case made upon which the Justices could convict at all in the peculiar circumstances of the case. He (Counsel) argued that in this house which was admitted by an inspector to contain antiquated fittings, there was nothing which would differentiate to the ordinary person between the flex which came through the ceiling for the supply of heat, and the other flex which also came through the ceiling and was for the supply of lighting. The two wires were connected to separate meters, and ran parallel in the floor boards above the ceiling. An inspector had also admitted that the only way he could distinguish the wires was by switching off at the meters.

He submitted that this was not a case which fell within the meaning of the section of the statute under which the prosecution was brought, namely, a case where artificial means had been used.

Without calling on counsel for the Corporation the Court dismissed the appeal with costs. In giving judgment the Lord Chief Justice said that the Justices had before them evidence of the fraudulent consumption of electric power, and therefore they were entitled to come to the conclusion appealed against. The other members of the Court agreed, and the appeal was accordingly dismissed with costs.

Winding-up Petitions

In the Companies' Court on January 16th Mr. Justice Maugham had before him a petition for the winding-up of Edison Bell, Ltd. Mr. Harman, for the creditors, said the petition was presented in May last year and the creditors had waited for a scheme which had not matured. There was no opposition, and he asked for the usual compulsory order. Mr. Clark, for the company, said that the bank had offered the company's assets for sale and he could not oppose the petition. His Lordship made the usual order.

Mr. Justice Maugham also heard a petition for the winding-up of Radia Electric Co. (Gloucester), Ltd. Counsel for the petitioning creditor said there was a supporting creditor. The company did not appear, and his Lordship directed the petition to stand over for a week.

The Marconiphone Co., Ltd., asked for a winding-up order against Terrytone Radio Products Co., Ltd. There was no opposition to the petition and the company was not represented. Mr. Justice Maugham made the usual compulsory order.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Wildbore's (Radio), Ltd.—Private company. Registered January 13th. Capital, £3,500 in £1 shares. Objects: To acquire the business of a lighting, electrical, wireless, gramophone and television engineer and dealer carried on by J. E. Wildbore at 68, Yorkshire Street, Oldham, as "Wildbore's." The first directors are: John E. Wildbore, 26, Marlborough Street, Oldham, governing director and chairman, and three others.

Boula Reflector Lamp Co., Ltd.—Private company. Registered January 13th. Capital, £2,000 in £1 shares. Objects: To acquire from Cosimo Conoce, Theodore Conoce and Frank Pascall patent No. 376122 and all other patents and designs held by them relating to the special process or processes for treating electric lamp bulbs and luminescent discharge tubes and process for the manufacture thereof, &c. The directors are: Frank Pascall, 156, Charing Cross Road, W.C.2; Richard A. Stringer, 75, Hornsey Lane, Highgate, N.7. Registered office: 156, Charing Cross Road, W.C.2.

Electric Service Station (Halifax), Ltd.—Private company. Registered January 13th. Capital, £2,500 in £1 shares. Objects: To acquire the business of the relay service now belonging to and carried on by Harry Wilkinson and Ronald C. Neaves at Wheatley Lane, Lee Mount, 4, Oak Lane, and 46, King Cross Street, Halifax, as the "Electric Service Station." The directors are: Harry Wilkinson (managing director), 4, Batley Street, Lee Mount, Halifax, and two others. Registered office: Barum House, Harrison Road, Halifax, Yorks.

Mica & Electro Products, Ltd.—Private company. Registered January 10th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical insulating materials, electrical instruments, tools, &c. The provisional directors are: Abraham Avtsine, 98, King's Road, Sedgley Park, Prestwich, Lancs, and Nathaniel Wither, 12, May Street, Monton, Manchester. Solicitor: F. M. Duncalf, 45, Cross Street, Manchester.

A. Crabtree & Co., Ltd.—Private company. Registered January 16th. Capital £1,000 in £1 shares. Objects: To carry

on the business of electricians, mechanical, automobile and general engineers and contractors, dealers in wireless telegraphy and other apparatus, &c. The directors are: S. Lewis, 524, Becontree Avenue, Chadwell Heath; Leonard H. Day, 45, Westbourne Terrace, Hyde Park, W.2. Registered office: 524, Becontree Avenue, Chadwell Heath.

J. C. Singer & Co., Ltd.—Private company. Registered January 16th. Capital £500 in £1 shares. Objects: To carry on the business of manufacturers and factors of, agents for and dealers in electrical devices, electric lighting equipment, radio, &c. The directors are: J. C. Singer, B. A. Singer, and David J. Singer, all of 29, Castle Avenue, Highams Park, E.4. Registered office: Werewell House, 193, Mare Street, Hackney, E.8.

E. H. Bond & Co., Ltd.—Private company. Registered January 14th. Capital £6,000 in £1 shares (1,500 10 per cent. cumulative preference and 4,500 ordinary). Objects: To acquire the business of an electrician, electrical engineer, &c., carried on by E. H. Bond at Bournemouth. The permanent directors are: Ernest H. Bond (managing director), Lands End, Erpingham Road, Bournemouth, and Herbert E. Phillips, 108, Carbery Avenue, West Southbourne, Bournemouth. Registered office: 50, Poole Hill, Bournemouth.

Resistance Microphones, Ltd.—Private company. Registered January 14th. Capital £200 in £1 shares. Objects: To carry on the business of manufacturers of microphones and apparatus pertaining to the transmission and reproduction of sound and light, &c. The subscribers (each with one share) are: Robert S. Breese, 2, Wimbledon Park Parade, S.W.19; Norman C. Gadsby, 137, Hamilton Road, West Norwood, S.E.27. The first directors are to be appointed by the subscribers. Secretary: Arthur Southgate.

Giles (Electrical Engineers), Ltd.—Private company. Registered January 14th. Capital £500 in £1 shares. Objects: To acquire the business of an electrical engineer, contractor and wireless dealer carried on by E. H. E. Giles as E. H. Giles & Co. and the Correctone Manufacturing Co., 147, High Holborn, W.C. The directors are: Ernest H. E. Giles, 38, Tonsley Road, S.W.18, and William H. Warren, 18, Chester Road, West Green, N.17. Registered office: 147, High Holborn, W.C.1.

Returns of Electrical Companies

W. H. Allen, Sons & Co., Ltd.—Satisfaction to the extent of £50,000 on December 23rd, 1932, of trust deed dated June 21st, 1926, and registered June 22nd, 1926, securing £100,000 5 per cent. 2nd mortgage debentures.

Budleigh Salterton Electric Light & Power Co., Ltd.—Satisfaction on December 23rd, 1932, of three debentures for £3,000, £2,000, and £2,000, dated December 8th, 1925, December 2nd, 1927, and July 17th, 1928, and registered December 11th, 1925, December 6th, 1927, and July 19th, 1928, respectively.

The nominal capital has been increased by the addition of £9,000 in £1 ordinary shares beyond the registered capital of £6,000.

Porlock & District Electric Supply Co., Ltd.—The nominal capital has been increased by the addition of £5,000 in £1 ordinary shares beyond the registered capital of £10,000.

Radio Renovators, Ltd.—The nominal capital has been increased by the addition of £400 beyond the registered capital of £100. The additional capital is divided into 400 10 per cent. participating preference shares of £1 each. Each ordinary share of £1 is being sub-divided into 20 shares of 1s. each.

Christy Brothers & Co., Ltd.—Satisfaction in full on December 31st, 1932, of mortgage debentures authorised November 2nd, 1903, and registered January 16th, 1909, February 4th, 1909, and June 17th, 1914, securing £5,000.

Brook Radio Co., Ltd.—C. A. Sandon, 1a, Sloane Court, S.W.3, was appointed receiver and/or manager on December 30th, 1932, under powers contained in debenture dated March 10th, 1932.

Mobilectric, Ltd.—J. Kirkman, accountant, of 57, Headrow, Leeds, ceased to act as receiver and manager on January 5th, 1933.

Superservices (Radio), Ltd.—R. H. Riant, 23, Redcliffe Street, Earls Court, S.W.10, was appointed receiver and manager on January 6th, 1933, under powers contained in debenture dated October 27th, 1932.

Spensers (London), Ltd.—Issue on December 29th, 1932, of £1,000 debentures, part of series already registered. Particulars also filed of £2,500 debentures (including £2,000 already registered), authorised by resolutions of October 5th, 1925, and December 6th, 1932, charged on company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £500.

A. J. Shrosbery & Co., Ltd.—Mortgage debenture dated December 28th, 1932, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. A. C. Shrosbery, 7, Abbeygate Street, Colchester.

Radia Electric Co. (Gloucester), Ltd.—Issue on March 1st, 1932, of £120 debentures, parts of a series already registered. (Notice filed January 6th, 1933.)

Ozonair, Ltd.—Capital, £40,000 in 77,600 preference and 322,400 ordinary shares of 2s. Return dated May 23rd (filed December 30th), 1932. 77,600 preference and 80,520 ordinary shares taken up. £4,252 paid on 42,520 ordinary shares. £11,560 considered as paid on 38,000 ordinary and 77,600 preference shares. Mortgages and charges, nil.

H. A. Lee, Ltd.—Capital, £1,500 in £1 shares. Return dated October 13th, 1932. 1,350 shares taken up. £550 paid. £800 considered as paid. Mortgages and charges, nil.

W. R. Sykes Interlocking Signal Co., Ltd.—Capital, £37,550 19s. in 46,173 "A" shares of 10s. and 41,327 "A" shares of 7s. Return dated November 9th, 1932. 41,327 7s. "A" shares issued and fully paid up. Mortgages and charges, £6,189.

Bideford and District Electric Supply Co., Ltd.—Satisfaction to the extent of £20,000 on January 3rd, 1933, of debentures authorised April 16th, 1926, and registered June 8th, 1926. (According to the register of mortgages the debentures registered June 8th, 1926, originally secured £25,000.)

City Notes

South Metropolitan Electric Light & Power Co.—The County of London Electric Supply Co., Ltd., which already holds over 95 per cent. of this company's ordinary shares, has made an offer to exchange the remaining ordinary shares on the basis of six of its ordinary shares for every seven South Metropolitan ordinary shares. The ordinary shares to be issued by the County Co. will participate in the final dividend for the year ended December 31st.

The Telephone & General Trust, Ltd., has announced the usual interim dividends on the 7 per cent. cumulative preference shares and 7 per cent. non-cumulative preferred ordinary shares.

The Southern Brazil Electric Co. reports a profit for 1931 of £44,109, as compared with £50,353 in 1930. After payment of debenture interest there was a net loss of £20,274, which with £154,639 difference in exchange is added to the debit balance carried forward, making this £218,121.

The Manila Electric Co. reports a total operating revenue of $5,262,418 for the year ended September 30th last, as compared with $5,500,388 in the preceding year. Expenses and taxes totalled $2,959,448, and after meeting interest charges there was a net income of $754,624 (against $1,181,312).

S. Smith & Sons (Motor Accessories), Ltd., announce the payment of the dividend on the 7½ per cent. cumulative preference shares for the half-year ended January 31st.

The Brazilian Traction, Light & Power Co., Ltd., has announced that in view of the continuance of exchange and remittance difficulties no dividend action is to be taken on the ordinary shares. A similar decision was made in October last in respect of the quarterly dividend.

Hopkinsons, Ltd., have declared a final dividend on the 7 per cent. cumulative preference shares for the half-year ending January 31st.

The Anglo-American Telegraph Co. has announced a final dividend of 1¼ per cent., less tax, on the ordinary stock and six per cent. preferred ordinary stock, and a dividend for the year of 1½ per cent., less tax, on the deferred ordinary stock.

The Melbourne Electric Supply Co., Ltd., reports a net profit for the year ended August 31st of £89,965, as compared with £100,480 in the preceding year, to which is added £435 brought in, making £90,401. It is proposed to pay a final dividend on the consolidated ordinary shares of 3¼ per cent., making 6¼ per cent., for the year, and to carry forward £363.

Crompton Parkinson, Ltd., inform us that the recent issue of 6 per cent. cumulative second preference shares of £1 each at 22s. per share has been considerably over-subscribed.

Edmundson's Electricity Corporation, Ltd.—Messrs. Lazard Bros. & Co. announce that the applications received from the debenture stockholders and preference shareholders in connection with the redemption of the five per cent. debenture stock substantially exceed the total value of the new four per cent. stock offered (£2,500,000).

Stocks and Shares

TUESDAY EVENING.

ONE of the principal financial features during the past few days has been the lifting by the Government of the ban hitherto placed upon new issues—a lifting which, if still somewhat partial, has the effect of releasing some of the springs which have been kept down by the prohibition placed upon this kind of business since the conversion of the five per cent. War Loan last July. The Government's wish was that nothing should then interfere with the success of that particular operation. The need of the moment is now past, and, although the Government still considers it inadvisable for capital to be exported from Great Britain, it acknowledges the desirability of allowing freer play to money within this country. In spite of vague talk of a possible British Government new loan that will replace some of the present floating debt, the 4½ per cent. debenture stocks of the Central Electricity and the London and Home Counties Authorities are better at 106.

Cables and Wireless

Holding the greater part of the rises which the prices have secured during the past two weeks, Cables & Wireless stocks continue to be an active market, and the centre of a good deal of speculative attraction. The preference stock is being acquired by people who are content to put it away, and to wait for a return on their money at some future date. The contention is heard not infrequently that, where income is not a pressing essential, it may be profitable to buy stock upon which dividends are meagre, but the price of which stands a good chance of appreciation. This used to be regarded as the rich man's argument. It appeals nowadays, however, to a wide circle, as is obvious, indeed, from the fact of so many investors preferring a speculative stock to another of more gilt-edged character, and being ready to accept risks inseparable from the desire to make profits, putting it bluntly, through capital appreciation.

Marconi Marines Improve

American Telephone & Telegraph is 5 lower at 155½. International Telephones remain at 11. Strong demand lifted Marconi Marines to 35s. 9d., a gain of 3s. 3d. Great Northern Telegraphs are £1 higher at 28½. Rentals are a few halfpence

down, at 5s. 9d., and so are Telephone Manufacturing at 4s. 1½d. Globe ordinary and preference reacted to 11⅛.

Home Electricity Supply

No price changes have taken place in the London Electricity Supply shares, but those of the provincial undertakings continue popular with investors. Lancashire Light and Power ordinary and 7 per cent. preference have both moved up to 32s. Hendon Electrics are better at 92s. 6d. Clyde Valley and Midland Electrical Power are up to 33s. 9d. and 35s. respectively. West Gloucestershire ordinary has gone ahead to 64.

British Power and Light ordinary change hands fairly freely, the basis being 17s.; the company's preference are a trifle firmer on the week at 24s. 10½d.

A Repayment of Debenture Stock

The London and Suburban Traction Company has a small amount—£23,927—of outstanding 5 per cent "A" debenture stock, and this it is proposed to redeem at 100 on April 15th next. The market price of the stock is 97½. To show how little business is done in the stock, it may be mentioned that the last-recorded bargain was at 96 on May 29th, 1931. In addition to this issue, the company has outstanding £182,635 of 4½ per cent. first mortgage debenture stock, quoted at 100, ranking in front, of course, of the 5 per cent. preference shares, now priced at 12s. These latter have received no dividend for nearly nine years. They are of the nominal value of £1 each, and the ordinary shares, also of £1, can be bought for about 1s. 6d. each.

The Melbourne Electric's Curious Case

The Melbourne Electric Supply Company has declared a final dividend of 3¼ per cent. on its consolidated ordinary stock, making 6½ per cent., free of British income tax, for the year, against 7½ per cent. in the preceding twelvemonth. The Government of Victoria bought the electricity undertaking some 2½ years back, and paid for it in 6 per cent. Commonwealth Government 5-year debentures. This was before any talk had arisen as to conversion of the Commonwealth debt into stock bearing a lower rate of interest. When this latter plan materialised, the 6 per cent. debentures were converted into 4 per cent. Commonwealth inscribed stock, and now, after negotiations, the company announces that a new arrangement has been reached, the details of which are not stated. However, all the gross income from investments and assets, less taxation, is to be available for distribution by way of dividend. The stock stands at 110, and the 8 per cent. first preference shares of £5 each at 5⅛.

Amongst other Dominion shares, Calcutta Electric ordinary have recently moved up to 50s. 6d. Cawnpore Electric ordinary changed hands a few days ago at 35s., the last-recorded business in Delhi Electric, a month back, was at 46s. Madras Electric ordinary shares have strengthened to 34s. 6d. Perak River Hydro-electric ordinary are quoted at a florin. There has been a demand for Toronto Power 4½ per cent. guaranteed debenture stock, the price of which is 106. Victoria Falls ordinary have hardened to 78s. 9d., and the preference shares are also a little better at 38s. 9d., both prices being ex the dividends deducted a week ago. No particular change has occurred in Mexican issues. Brazilian Tractions are weaker at 11⅞.

Calcutta Tramways

Calcutta Tramways recently notified the holders of its 7 per cent. debentures, of the company's intention to repay the latter in April next. By way of replacement, £250,000 of 5 per cent. second debenture stock has been created, and the issue came to market this—Tuesday—afternoon for the first time. It is offered at 101, free of stamp and fee, subject to permission to deal being given by the Stock Exchange Committee. Interest payments will be made in April and October, that for the next April being for a small amount. The stock cannot be repaid under 102.

The Manufacturing Group

After the very considerable rises which took place during the first days of the present year in the leading shares of the electrical manufacturing and equipment companies, it is not surprising that there should be something of a halt. Brush ordinary have at last moved upwards, and at 37 show a gain of 2 points. Stock changed hands to-day, Tuesday, at 31½. Henleys have hardened to 6 5/16, General Electrics to 4⅓. Enfields at 4⅛, Callenders at 3¼, British Insulated at 3½, hold their gains of last week. Siemens remain steady at 27s. 6d.; the debenture stock is better at 101½. The rise in Associated Electrical Industries ordinary shares, which lifted the price to 20s. 9d., has served to bring in sellers, and the quotation is back to £1. English Electrics, which rose 3s. 3d. last week, have reacted to 12s. 6d., and the florin rise in the price of the preference is followed by a fall of 6d. to 16s. 6d. Rumours of a possible resumption of dividend on the preference shares are partly responsible for the recent sharp advance in the prices.

Crompton Parkinson state that the company's recent issue of 173,000 new 6 per cent. second preference shares, offered at 22s., was considerably over-subscribed. In the iron and steel groups, Babcocks are 6d. to the good at 2⅛. Vickers, however, drooped to 6s. 9d. The rubber market is despondent upon a fall in the produce to 2¼d. per lb.

Share List of Electrical Companies

	Nom.	Approx. Dividend. 1930.	1931.	Price, Jan. 17.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	70/–	—	4 5 9
Brompton Ordinary	1	8½	8½	33/6	—	4 3 7
Central Electricity 4½% Deb.	Stock	4½	4½	106	+1	4 5 0
Charing Cross Ordinary	1	8½	8½	33/6	—	4 3 7
Chelsea	1	8½	8½	33/–	—	4 4 10
City of London	1	10	10	34/6	—	4 1 2
Clyde Valley	1	8	7	33/9	+⅛	4 2 10
County of London	1	11	10½	50/9	—	4 2 8
Edmundsons' 7% Pref.	1	7	7	29/6	—	4 15 0
Elec. Dis. Yorkshire	1	9	9	42/6	—	4 4 8
Elec. Supply Corporation	1	11	11	58/9	—	3 14 10
Kensington Ordinary	1	8	8	33/6	—	4 3 7
Lancs. Light and Power	1	6½	7	32/–	+9d.	4 7 6
London & Home Counties 4½% Deb.	Stock	4½	4½	106	+1	4 5 0
London Electric	1	9	9	33/6	—	4 3 0
Metropolitan	1	10	10	47/6	—	4 4 3
Midland Counties	1	7	7	33/3	—	4 4 2
Mid. Elec. Power	1	8	8	35/–	+6d.	4 11 5
North Eastern Electric Ordinary	1	6	6	28/6	—	4 4 3
Do. 7% Pref.	1	7	7	31/6	—	4 9 0
Northampton	1	10	10	50/–	—	4 0 0
Notting Hill 6% Pref.	10	6	6	12½	—	4 14 0
North Met. Elec. 6% Pref.	1	6	6	28/6	—	4 4 3
St. James' and Pall Mall	1	8	8	33/6	—	4 3 7
Scottish Power	1	8	8	35/–	—	4 11 5
South London	1	8½	8½	33/–	—	4 4 10
Urban Ordinary	1	7	7	36/3	—	3 17 3
Westminster Ordinary	1	8½	8½	33/–	—	4 4 10
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	16/3	—	9 4 8
Yorkshire Elec.	1	8	8	40/–	—	4 0 0
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	82½	—	4 17 0
Metropolitan	,,	3½	2½	61	—	4 2 0
Do. District	,,	5	4½	61½	—	7 6 4
Underground Electric	1	8	7	19/6	—	7 3 7
TELEGRAPH AND TELEPHONES.						
American Tel. & Tel.	$100	9	9	155½	–5	5 15 9
Anglo-Am. Tel. Pref.	Stock	6	6	106½	—	5 12 9
Do. Def.	,,	1½	1½	26½	+½	5 13 2
Cables & Wireless 5½% Pref.	,,	5½	2½	83½	—	3 5 10
Do. A 7½% Ord.	,,	—	Nil	29½	–1	—
Do. B Ord.	,,	—	Nil	12	–½	—
Globe Tel. and T. Ord.	10	8½	Nil	11½	–¼	—
Do. do. Pref.	10	6	6	11½	–⅛	5 7 8
Great Northern Tel.	10	20	20	28½	+1	7 0 6
Marconi-Marine	1	15	10	35/9	+3/3	5 12 0
Oriental Telephone Ord.	1	12	12	3	+⅛	*4 0 0
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	—	—	3/3	—	—
Do. do. 2nd Pref.	5	—	—	3/9	—	—
Do. do. 5% Deb.	Stock	—	—	7	—	—
British Electric Traction Def. Ord.	,,	5	5	255	—	—
Do. do. Pref. Ord.	,,	8	8	132½	—	6 0 9
Brazil Traction	100	—	—	11⅞	–⅛	—
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	100½	—	4 19 6
London & Sub. Trac. 5% Pref.	1	Nil	Nil	12/–	—	—
London United Tram Deb.	Stock	4	4	65½	—	6 2 2
Mexico Trams, 5% Bonds	—	5	5	47½	—	10 10 6
Mexican Light Common	100	Nil	Nil	10	—	—
Do. 7% Pref.	100	7	7	15	—	—
Do. 1st Bonds	—	5	5	70	—	7 2 10
Victoria Falls Ord.	1	15	15	78/9	+9d.	3 15 9
Yorkshire (West Riding)	1	Nil	Nil	5/–	—	—
MANUFACTURING COMPANIES.						
Assoc. Elec. Ord.	1	6	4	20/–	–9d.	4 0 0
Do. Pref.	1	8	8	32/–	—	5 0 0
Babcock & Wilcox	1	14	14	42/6	+6d.	—
British Aluminium Ord.	1	10	5	23/9	—	4 4 0
British Insulated Ord.	1	15	15	70/–	—	4 5 9
Brush Ord.	Stock	5	Nil	37	+2	—
Callender's	1	15	15	3¼	—	4 12 4
Do. 6½% Pref.	1	6½	6½	28/3	—	4 12 0
Crompton Parkinson Ord.	5/–	30	24	21/3	—	5 7 6
Do. 8% Pref.	1	8	8	30/–	—	5 6 8
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	6 2 5
Do. 5% Deb.	Stock	5	5	100	—	5 0 0
Electric Construction	1	Nil	Nil	8/9	—	—
Enfield Cable Ord.	1	25	25	4⅛	—	5 8 1
English Electric	1	Nil	Nil	12/6	–9d.	—
Do. do. Pref.	1	Nil	Nil	16/6	–6d.	—
Ever Ready	5/–	35	35	27/9	—	6 6 1
Ferranti Pref.	1	7	7	23/9	—	5 18 0
G.E.C. Pref.	1	6½	6½	29/–	—	4 9 8
Do. ord.	1	10	8	41/3	+6d.	3 17 6
Henley's	1	30	30	6 5/16	+⅛	4 15 0
Do. 4½ Pref.	5	4½	4½	5½	—	4 5 9
India-Rubber	1	Nil	Nil	2/6	—	—
Johnson & Phillips	1	10	5	1	—	5 0 0
Siemens Ord.	1	7½	7½	27/6	—	5 9 1
Telegraph Construction	£1	Nil	Nil	16/3	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1931

3115. "Electric gaseous discharge devices." Claude-Lumière, Soc. Anon. pour les Applications des Gaz Rares à la Lumière Procédés G. Claude. November 5th, 1930. (385311.)

3676/7. "Means for electrically producing oscillatory or reciprocatory motion." British Thomson-Houston Co., Ltd., and H. G. Clinker. (Legal representative of R. C. Clinker, deceased.) March 20th, 1931. (Additions to 379711.) (385312/3.)

11140. "Oscillation control apparatus." Communication Patents, Inc. August 2nd, 1930. (385314.)

11675. "Electric circuit interrupters with contacts immersed in oil or other insulating liquid." H. Pearce and Associated Electrical Industries, Ltd. April 20th, 1931. (385316.)

14787. "Systems of electric motor control." International General Electric Co., Inc. May 19th, 1930. (385296.)

16335. "Electric switch mechanism, automatically discriminating between different supply sources." H. Loy. June 4th, 1931. (385297.)

17059. "Sparking plugs." J. Weller. June 12th, 1931. (Cognate applications, 18681/31, 19366/31, and 19672/31.) (385321.)

17214. "Wall-boxes for containing switches, coupling sockets and other electrical units." J. A. Crabtree. June 13th, 1931. (385298.)

17241. "Number-sending arrangements for automatic telephone or like systems." M. Tchoubritch, and Soc. Nouvelle de Construction Téléphonique Brevets Tchoubritch-Derval. June 15th, 1931. (385299.)

17326. "Electrical timing and elapsed time signalling devices." Siemens Bros. & Co., Ltd., H. E. Humphries, and R. G. Dixon. June 15th, 1931. (385301.)

17514. "Electric signalling systems for controlling road traffic." Siemens & General Electric Railway Signal Co., Ltd., and T. R. Starr. June 16th, 1931. (385302.)

17590. "Luminous signal devices particularly adapted for air traffic." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 13th, 1931. (385325.)

17681. "Dry surface contact rectifying devices." N. C. F. Jensen. June 18th, 1931. (385305.)

18770. "Protective apparatus for electric circuits." International General Electric Co., Inc. June 28th, 1930. (385334.)

19457. "Vacuum electric tube devices." E. Y. Robinson, and Associated Electrical Industries, Ltd. July 6th, 1931. (385340.)

20959. "Electric time-signalling devices." L. S. Davall, E. A. Richards, A. C. Cuss, and H. Deller. July 22nd, 1931. (385343.)

22823. "Resonance relay according to the Ferraris principle." Landis & Gyr Soc. Anon. September 2nd, 1930. (385346.)

22891. "Alternating-current electric motors for driving lifts and the like." F. Punga. August 13th, 1931. (385349.)

23348. "Oscillation generators with cyclically variable frequency." Communication Patents, Inc. December 30th, 1930. (385350.)

25084. "Multi-way electric switches." British Thomson-Houston Co., Ltd., and S. H. Franklin. September 7th, 1931. (385358.)

26165. "Electrical contact devices particularly for thermionic-valve holders." W. W. Robinson. September 18th, 1931. (385362.)

26166. "Means for holding thermionic tubes." W. W. Robinson. September 18th, 1931. (385363.)

26167. "Electrical contact devices for thermionic valve-holders." W. W. Robinson. September 18th, 1931. (385364.)

26420. "Mounting of electrical units, such as fuses, in distribution boxes and the like." J. A. Crabtree. September 22nd, 1931. (385367.)

28603. "Magnetos." J. Lucas, Ltd., E. A. Watson, and H. E. Whitehouse. October 15th, 1931. (385379.)

29116. "Automatic telephone and like selective systems." Siemens Bros. & Co., Ltd., W. G. Patterson, and D. P. Long. October 20th, 1931. (385384.)

29672. "Protective apparatus for electric circuits." British Thomson-Houston Co., Ltd. October 25th, 1930. (385388.)

29899. "Electric circuit-breaking apparatus." R. E. Ellis (Metropolitan Device Corp.). October 28th, 1931. (385389.)

31418. "Permanent magnets." Darwins, Ltd., and A. C. Catherall. November 13th, 1931. (385400.)

31972. "Setting or adjusting means for variable-capacity electrical condensers and other instruments whereby a law or formula may be introduced." Pye Radio, Ltd., E. V. Root, and C. E. M. Butler. November 18th, 1931. (385404.)

33174. "Electromotive driving devices for selectors in remote-signalling installations and more particularly for telephone installations." Siemens & Halske Akt.-Ges. December 1st, 1930. (385412.)

33188. "Telegraph systems." Automatic Electric Co., Ltd., and H. H. Harrison. November 30th, 1931. (385414.)

33873. "Loud speakers." Magnavox Co. July 15th, 1931. (385418.)

34874. "Electric cables." British Thomson-Houston Co., Ltd. December 16th, 1930. (385422.)

35516. "Electric transformer for use in superposing single-phase control currents or impulses on to a.c. networks." Landis & Gyr Soc. Anon. December 24th, 1930. (385427.)

1932

148. "Thermostatic devices for controlling electric circuits." Chance Bros. & Co., Ltd., and J. H. Abbink-Spaink. January 2nd, 1932. (385432.)

760. "Electromagnetic selectors." General Electric Co., Ltd., and W. R. Rose. January 11th, 1932. (385440.)

1806. "Magneto-electric machines." F. Quast. January 20th, 1932 (Addition to 300452). (385452.)

2822. "Electric clocks." C. W. Alexander and C. A. Lovett (legal representatives of A. E. J. Ball, deceased), and Gent & Co., Ltd. January 30th, 1932. (385457.)

3372. "Apparatus for electrically heating and maintaining heat in feeding-bottles or like vessels." G. Schmidt and Dr. S. T. H. Weber. February 4th, 1932. (385463.)

4083. "Arc rectifiers." Siemens-Schuckertwerke Akt-Ges. March 31st, 1931. (385465.)

5560. "Electric motors." British Thomson-Houston Co., Ltd. February 25th, 1931. (385470.)

6857. "Arc-rupturing arrangements for electric switches." British Thomson-Houston Co., Ltd. March 5th, 1931. (385478.)

6959. "Adapters for electric lamp and like circuits." P. Hochkopper, E. Assmann, and O. Winkle (trading as P. Hochkopper & Co.). March 8th, 1932. (385480.)

9167. "Synchronising devices with a controlled oscillation generator, especially for television apparatus." Fernseh Akt.-Ges. April 4th, 1931 (Addition to 366598). (385492.)

9665. "Thermionic valves and like electric discharge devices, and methods of manufacturing the same." Telefunken Ges. für Drahtlose Telegraphie. April 2nd, 1931. (385496.)

10031. "Electrical remote control systems suitable for remotely tuning radio and like tunable receivers." Marconi's Wireless Telegraph Co., Ltd. April 7th, 1931. (385498.)

10564. "Plaster-excluding devices for use in electrical wall boxes." J. A. Crabtree. June 13th, 1931 (Divided application on 385298). (385308.)

10565. "Electrical switches and bell-pushes for mounting in wall boxes." J. A. Crabtree. June 13th, 1931 (Divided application on 385298). (385309.)

11246. "Sparking plugs for internal-combustion engines." Imperial Airways, Ltd., G. E. Humphrey and H. L. Hall. April 19th, 1932. (385505.)

11847. "Fuses." E. Adams, and S. W. Blakslee. April 25th, 1932. (385506.)

13375. "Plate systems for variable condensers." Ritscher Ges. December 2nd, 1931. (385508.)

13957. "Control device for radio-receiving and the like apparatus." J. C. Wilson. May 15th, 1931. (385514.)

14079. "Rectifiers." C. Hambuechen. May 18th, 1932. (385515.)

14755. "Electric fuse links." Southern States Equipment Co. November 26th, 1930 (Divided application on 26879/31). (385517.)

15222. "Radio direction-finding apparatus." Aga-Baltic Radio Aktiebolaget. May 30th, 1931. (385521.)

15327. "Air-spaced long distance telephone cables." Siemens & Halske Akt.-Ges. May 30th, 1931. (385523.)

16708. "Regenerative radio and similar high-frequency receivers." Marconi's Wireless Telegraph Co., Ltd. June 12th, 1931 (Addition to 341786). (385525.)

17289. "Selector for use in long-distance communication systems, in particular for telephone systems provided with electromotive driving mechanism." Siemens & Halske Akt.-Ges. June 18th, 1931. (385529.)

17395. "Diffusion or mercury-vapour lamps." U. Lamm., and Allmänna Svenska Elektriska Aktiebolaget. June 20th, 1932. (385531.)

17796. "Electric signalling systems." Dr. F. Chamier. June 23rd, 1932. (385535.)

17803. "Picture-telegraph and like transmission systems." Etablissements E. Belin. June 30th, 1931. (385536.)

17911. "Process of and apparatus for producing tipless and stemless electric incandescent lamps." O. Proscholdt. June 24th, 1932. (385537.)

19587. "Synchronising systems for television and other purposes." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. July 11th, 1931. (385546.)

19775. "Magnetos." R. Bosch Akt.-Ges. September 9th, 1931. (385547.)

21482. "Electric switches or circuit-breakers." International General Electric Co., Inc. July 31st, 1931. (385556.)

21944. "Radio-receiving circuits." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 18th, 1931. (385560.)

22605. "Multi-core power cables." W. W. Triggs (Felten & Guilleaume Carlswerke Akt-Ges.). August 12th, 1932. (385564.)

24097. "Electric switches." International General Electric Co., Inc. August 29th, 1931. (385567.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 11th :—

Hilux, No. 535908 and **Hilo**, No. 536055. Class 4. Electric carbons.—Charles H. Champion & Co., Ltd., 60-66, Wardour Street, W.1.

Metcraft. No. 527658. Class 8. Radio-telephonic and telegraphic instruments and apparatus and parts thereof.—Sydney Marks, trading as S. Marks & Son, 57, James Street, N.W.1.

Westric. No. 536331. Class 8. Apparatus consisting of controlling, measuring or indicating devices employed in connection with the charging and discharging of storage batteries.—Westinghouse Brake & Saxby Signal Co., Ltd., 82, York Road, King's Cross, N.1.

Hellesens. No. 536780. Class 8. Electric dry batteries (not for medical purposes).—Hellesens, Ltd., Morden Road, South Wimbledon, S.W.19.

Barlux. No. 535661. Class 13. Electric lamps (ordinary).—Low Tension Luminous Tubes, Ltd., 146, Bishopsgate, E.C.2.

Crysteel. No. 535676. Class 13. Cooking stoves, refrigerating chambers and water heaters.—Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, N.17.

Bicalov. No. 536000. Class 18. Electric welding plant.—British Insulated Cables, Ltd., Prescot, Lancs.

Ekcozene. No. 535697. Class 50. Moulding powders and moulded articles, all made of synthetic resin.—E. K. Cole, Ltd., Priory Lane, Southend-on-Sea.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Accrington (LANCS).—Pithead baths; J. W. Lee, Ltd., builders, Yarrow Saw Mills, Chorley. Offices, 371-3, Blackburn Road; F. Greenhalgh.

Acton.—Houses (150), various roads; Costain & Sons, Ltd., 7, Norfolk Street, London, W.C.2. Additions for the Portable Electric Power Co., Ltd., Park Royal Road; W. E. Matchett, architect, 47, Victoria Street, S.W.1.

Airdrie.—Houses (132), for the Corporation; burgh surveyor.

Aldershot.—Maternity unit and nurses' quarters at the hospital, St. George's Road; H. G. Baker, architect, 41, Grosvenor Road.

Angmering-on-Sea (SUSSEX).—Hotel (£20,000), for Messrs. King, Brixton, London, S.W.

Arbroath.—Houses for the Corporation at Ladyloan (£4,331); burgh surveyor.

Ashton-under-Lyne.—Houses (132) and flats; borough surveyor.

Bacup.—Methodist church, Heald; trustees' secretary.

Bexhill-on-Sea.—Additions to Albany Hotel, Sea Road; J. E. Maynard, architect.

Birmingham.—Hospital, Edgbaston; city engineer.

Bishop's Stortford.—Alterations and additions to branch premises, Boot's Cash Chemists, 12, Potter Street; architect's dept., Station Street, Nottingham.

Blackpool.—Baths, Harrowside; borough engineer. Hotel, Promenade; Pembroke Estate.

Bootle.—Houses (83), Aintree Road; Williams & Kelly. Estate development, Earl Road; Sugden & Crook. Rehousing, Pleasant View area; borough engineer.

Boston.—Reconstruction, Assembly Rooms, with market and shops (£5,025); borough surveyor.

Bradford.—Houses (25), Harry Street; J. A. Dobson, Dudley Hill. Shops, Delph Grove and Delph Drive, Clayton; A. Shepherd & Sons.

Bridlington.—Extensive alterations, Regent House, Promenade, for R. Allen & Co., Ltd.

Brownhills (STAFFS).—Houses (50); U.D.C. surveyor.

Bury St. Edmund's.—Reconstruction, Three Kings Hotel; Hunter & Oliver, Ltd. Business stores, Cornhill, for Montague Burton, Ltd., Leeds; staff architect.

Caernarvonshire.—Elementary school at Dolgarrog for the C.C. (electric lighting installations); A. Doyle, builder, Port Dinorwic, Caernarvon.

Caterham.—Library, Whyteleafe School; Jarvis & Richards. Five shops, Whyteleafe Road; Bethell & Swannell. Extensions to nurses' home, Browning Bethany Homes; Culpin & Bowers.

Cheshire.—Alterations and extensions, Crewe Police Station, for the C.C.; F. A. Browne, county architect, Chester.

Cleckheaton.—Houses (24), Bradford Road, for Robinson & Crowther. Works extensions, Westgate, for the Lion Confectionery Co.

Colchester.—Works at the harbour; British Overseas Projects Advisory Corpn., Ltd.

Cosham (HANTS).—Estate development; W. P. Winter & Son, Ltd.

Dorking.—Sewage pumping station with plant and power units, &c., Westcott; G. Sawyer, R.D.C. surveyor, 72, High Street.

Dover.—Houses (94), and flats; A. E. Guest, Ltd., builders, Wallington, Surrey.

Ealing.—Houses (43), Clauson Avenue; W. Gradwell & Co. Houses (24), Royal Crescent, and shops, North Circular Road; R. Lancaster & Sons, Ltd. Houses (20), Ruislip Road; R. A. C. Churchward, architect, 12, Victoria Street, S.W.1. Houses (160), and shops, Empire Road; J. M. Wilson, architect for the Wonder House, Ltd. Flats (150), Wordsworth Avenue; Greenford Estates, Ltd., Costons Lane, Greenford.

Fifeshire.—Central kitchen at Joint County Asylum (£5,700); A. D. Haxton, architect, Leven.

Friern Barnet.—Flats, Fernwood Road and Oakleigh Road; J. Hutchinson.

Gravesend.—Alterations and additions to Gravesend and North Kent Hospital, Stuart Road; T. Bennett. Council Office extension, Woodville Terrace; borough engineer.

Hampton.—Six shops, High Street; H. & L. Sloggett.

Hanley.—Alterations and additions to 105, York Street; Howells (Electric Motors), Ltd.

Hastings.—Restaurant for the pier for Hastings Pier Co., Ltd.; Callow & Callow, architects.

Hednesford.—Alterations and improvements to premises, Market Street, for Stammers, Ltd., New Street, Walsall.

Huthwaite.—Houses (40), Chesterfield Road site; E. W. Bostock, architect, Morden Avenue, Hucknall, Notts.

Hyde.—Extensions to leather works, Mary Street; C. Watkin & Co.

Irish Free State.—(ENNISCORTHY, Co. WEXFORD).—Church at the Ballagh, for the Very Rev. Canon Maher; Ashlin & Coleman, architects, 7, Dawson Street, Dublin. (MIDLETON, Co. CORK).—Houses (26), Townparks; J. J. Bowen, architect, Fermoy.

Irlam (LANCS).—Houses (27), Roscoe Road, for A. Sargent.

Jedburgh.—Extensions to the North British Rayon Factory at Canongate Mills; the manager.

Leeds.—Buildings, Regent Street, Saint Street, and Pendulum Street; J. W. Watson & Sons.

Liverpool.—Orphanage, Woolton Road, Woolton, for the Board of Management of the Liverpool Orphanage, Myrtle Street (electric lighting installations); J. Jones & Sons (Woolton), Ltd., builders, Higher Road, Hunts Cross.

London.—(BATTERSEA).—Additions to 253, Lavender Hill; E. Evans & Sons. (BERMONDSEY).—Flats, Bevington Street; Gale, Heath & Sneath. (EAST HAM).—Additions to St. Michael's School, Arthur Road; Marshall & Partners. Factory extension, Greenhill Grove; Leslie Bros. (FULHAM).—Flats, 45, Napier Avenue; W. Doddington. (TOTTENHAM).—Alterations to 570, High Road; A. Burgess, Ltd. (WEST HAM).—Shops, Angel Lane; Wm. B. Sinclair, architect, Craigs Court House, Craigs Court, London, S.W.1. (WOOLWICH).—Clinic to North Woolwich; borough engineer.

Longton (STAFFS).—Alterations and additions, Methodist Church, Stafford Street; trustees.

Manchester.—Houses (176), Parrs Wood Road, South, East Didsbury; J. T. Scott, builder, 41, Beech Road, Chorlton-cum-Hardy. Additions to Hulme Hall, Oxford Place, Victoria Park for University Authorities; T. Worthington & Sons, 178, Oxford Road. Alterations to premises at the corner of Stretford Road and Clopton Street, Hulme, for Royal London Mutual Insurance Co., Ltd., 196, Deansgate; Railton & Knowles, 12, York Street. Rebuilding of Bank Bridge Works, Clayton; C. H. Godfrey & Son.

Middlesbrough.—Church (£15,000), Linthorpe Road; Rev. C. H. Sellwood-Godwin, vicar, St. Aidan's Church.

Mossley (LANCS).—Post Office extensions for H.M. Office of Works, King Charles Street, London, S.W.

Newcastle-on-Tyne.—Rebuilding of Messrs. Bradburn's premises (£8,000); J. Oswald & Sons, architects, 2, Worswick Street.

Northampton.—Extensions to Town and County Boys' School (£3,500); governors.

Northwich.—Houses (58); J. Birtwistle, R.D.C. surveyor, Whitehall, Hartford, Cheshire.

Paignton.—Houses (35), Dartmouth Road; Major Waycott. Six shops, Manor Road; Mr. Cole.

Paisley.—Houses (500) for the Corporation; burgh surveyor.

Petersfield (HANTS).—Houses (34); surveyor, 14, King George Avenue.

Portsmouth.—Winter Gardens, Southsea Terrace; Southsea Development Co., Ltd. Swimming baths, Hilsea (£16,500); city engineer.

Preston.—Cotton spinning mill, Peel Hall Street, for the Lancashire Cotton Corporation.

Ramsgate.—New St. Laurence Cliffs Hotel and Public Hall, &c.; H. H. Stroud, architect, High Street.

Reading.—Houses (292), Cressington Road Estate; Hayes Bridge Estate, Ltd., 4, Warwick Square, Victoria, London, S.W.1. Houses (32), Lawrence Hill Estate, for Francis Bros., Tilehurst. Houses (200) on section three of the Whitley Housing Estate (£59,342); Gee, Walker & Slater, Ltd., contractors, Uttoxeter Old Road, Derby.

Reigate.—Houses (30), Stuart Road; borough surveyor. Junior mixed school (200 places) for the Borough E.C.; H. Davies, town clerk.

Rickmansworth (HERTS).—Houses (44), Mile End site; U.D.C. surveyor.

Rugby.—Hotel premises at the corner of Hillmorton Road and Slade Road, Benn's Farm Estate, for F. A. Whittaker (electric lighting installations); Willard, Son & Ellingham, Boughton House, Market Place. Water supply scheme (£22,000); borough water engineer.

Runcorn.—Houses (23); U.D.C. surveyor.

Scarborough.—Bathing pool improvements (£7,000) and reconstruction Aquarium baths; borough engineer.

Sheffield.—Houses (20), Bawtry Road; G. R. Parkin. Houses (44), Longfield Road; A. Ramsay.

Southgate.—Development of Oak Lodge Estate; Matthews & Son. Shop and flats, Hazelwood Lane; A. Pryke. Additions to Chase Bank Nursing Home; Miss F. Jarvis.

Southport.—Land development corner of Montrose Drive and Hesketh Drive; W. Morris Bros.

South Shields.—Houses (46), Tyne Dock; J. P. Watson, borough engineer, Town Hall. Alterations to school, Westoe Village; H. Hill, architect.

Spenborough.—Houses (50); U.D.C. surveyor, Cleckheaton.

Stanley (YORKS).—Church, Leeds Road, Newton Hill, for the trustees of the Primitive Methodist (electric lighting installations); Dinsley & Moss, 17, Union Street, Chorley.

Stockport.—Public baths extensions (£4,360); borough surveyor.

Stockton-on-Tees.—Development of Highfield Estate; R. B. Bainbridge.

Stoke-on-Trent.—Alterations to North Staffs Hotel for the L.M.S. Railway Co.

Stretford.—Flats, Birch Avenue and Stretford Road: Residential Flats, Ltd.

Swinton and Pendlebury.—Houses (70), Moss Lane, Pendlebury; U.D.C. surveyor.

Teddington.—Conversion of Cottage Hospital into flats; Captain C. F. Hobday.

Thirsk (YORKS).—Rebuilding of the Regent Cinema; A. J. Oates, builder, 2, Pasture Road, Goole.

Torquay.—Houses (34), Barton and Westhill (£11,000); A. E. Guest, Ltd., 1a, Lambton Road, London, N.19.

Tunbridge Wells.—Extensions to business stores, The Five Ways, for Waymarks, Ltd.

Twickenham.—Public baths, Richmond House Estate (£15,940); borough engineer.

Ware.—Reinstatement of Balkesware (mansion) for Lord Gerard.

Warlingham.—Houses (72), Hamey Green; P. Richardson, Croydon.

Warwick.—Piston works extensions for the C. M. D. Engineering Co. Business premises; Coventry and District Co-operative Society, Ltd.

West Wickham (KENT).—Cinema; C. H. Gibson, Ltd., builders, Croydon.

Wolverhampton.—Houses (48), Finsbury Avenue; J. J. & S. Hayes. Houses (42), Gretna Crescent; H. B. Pownall. Houses (27), St. Martin's Road; J. Birthwistle, Ltd. Development, Aldersley Estate; Walker, Lloyd & Hill. Five shops and houses, Dudley Road; H. & J. N. Patten. Stove house and transformer shop, Stafford Road; Electric Construction Co., Ltd.

Worthing.—Alterations and improvements to Literary Institute, Montague Street; A. T. W. Goldsmith, chartered architect, Liverpool Chambers, Liverpool Gardens.